

**C G I A R**

**Consultative Group on  
International Agricultural Research**

**ANNUAL REPORT 1991**



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## The Consultative Group on International Agricultural Research (CGIAR)

The Consultative Group on International Agricultural Research (CGIAR) is an informal association of 40 public and private sector donors that supports a network of 17 international agricultural research centers. The Group was established in 1971.

CGIAR centers have trained over 45,000 agricultural scientists during the past 20 years. The types of training provided ranged from mid-level regional courses to post-doctoral programs at CGIAR centers. Many scientists from developing countries who were trained at CGIAR centers form the nucleus of and provide leadership to national agricultural research systems in their own countries.

The international centers supported by the CGIAR are part of a global agricultural research system. The CGIAR functions as a guarantor to developing countries, ensuring that international scientific capacity is brought to bear on the problems of the world's disadvantaged peoples.

Programs carried out by CGIAR-supported centers fall into six broad categories:

- **Productivity Research**

Creating or adopting new technologies (such as the "dwarf" varieties of wheat and rice which brought about Asia's green revolution) to increase productivity on farmers' fields

- **Management of Natural Resources**

Protecting and preserving the productivity of natural resources on which agriculture depends

- **Improving the Policy Environment**

Assisting developing countries to formulate and carry out effective food, agriculture and research policy

- **Institution Building**

Strengthening national agricultural research systems in developing countries

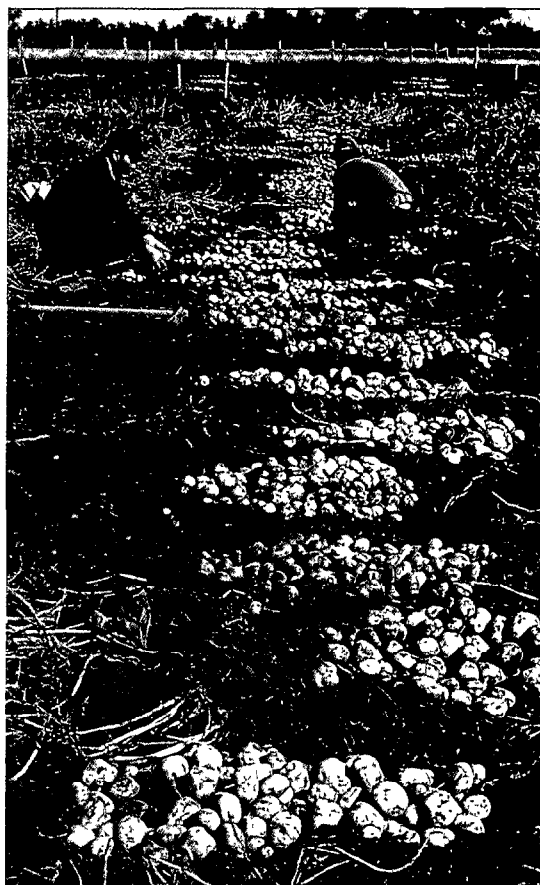
- **Germplasm Conservation**

Conserving germplasm and making it available to all regions and countries

- **Building Linkages**

Helping to create or strengthen linkages between developing country institutions and other components of the global agricultural system

Food productivity in developing countries has increased through the combined efforts of the CGIAR centers and their associates in developing countries. The same efforts have brought about a range of other benefits, such as increased farm income, reduced prices of food, better food distribution systems, better nutrition, more rational policies and stronger institutions.



*At the International Potato Center, scientists have spent nearly 20 years developing potato cultivars that are pest resistant, higher yielding and more appealing to a hungry world.*

# Introduction



ISNAR / T. A. Taylor

**A**nniversaries encourage institutions, no less than people, to engage in introspection. An obsession with “soul searching” is, however, an inward looking luxury that dynamic institutions dealing day in, day out with human problems cannot afford. The CGIAR, therefore, paused only briefly for stocktaking at the completion of its 20th year, engaging itself more intensely in a forward-looking exercise, that of setting priorities for the medium and long term.

This annual report tries to capture all these facets in the life of the CGIAR: a brief look at solid achievements whose impact continues into the present and will endure in the future; an account of how priorities are being set to meet the challenges of our times; an introduction to a new venture in the CGIAR system—research in agroforestry and forestry; and a financial accounting.

The founders of the CGIAR were convinced that by supporting strategic agricultural research on a global scale they could trigger a major contribution to human progress. This has been accomplished perhaps in more areas than was originally envisaged and, certainly, in endeavors that the CGIAR undertook ahead of most others.

Investment in the CGIAR has brought impressive returns to donors and developing countries alike. It has at the same time helped in the development of unique research institutions—“the centers” as they are generically known—that blend scientific expertise with a commitment to human well-being.

This annual report includes highlights of the impact of research conducted by the CGIAR centers that made presentations at International Centers Week. We plan to repeat this format in future editions of the annual report as well.

The record suggests that the CGIAR system has the capacity to provide solutions in two of the three areas (food, population and the environment) that are at the heart of human development. Continued support for international agricultural research thus offers the world’s disadvantaged hope that some of their most pressing problems will remain on the “action list” of international development in the next 20 years and beyond—as they did in the past 20 years.

The CGIAR system cannot, however, fulfill its responsibilities unless its financial resources match the demand for its services and output. We realize that donors today face many difficulties including domestic demands on their budgets and increasing competition for overseas development assistance funds. And yet, the confluence of environmental pressures, the need to feed the increasing populations of tomorrow and the pressures of poverty and malnutrition reinforce our conviction that the enterprise is too important for underinvestment to hamper its effectiveness.

Alexander von der Osten  
*Executive Secretary*

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## CGIAR Centers



ICRISAT

### **CIAT**

#### **Centro Internacional de Agricultura Tropical**

Apartado Aereo 6713, Cali, Colombia. Founded 1967. To contribute to the alleviation of hunger and poverty in tropical countries by applying science to the generation of technology that will lead to lasting increases in agricultural output while preserving the natural resource base. Research in germplasm development in beans, cassava, tropical forages and rice for Latin America; and research in resource management in humid agroecosystems in tropical America: hillsides, forest margins and savannas.

### **CIMMYT**

#### **Centro Internacional de Mejoramiento de Maiz y Trigo**

Lisboa 27, P.O. Box 6-641, Mexico 06600, D.F., Mexico. Founded 1966. To help the poor by increasing the productivity of resources committed to maize and wheat in developing countries while protecting the environment, through agricultural research and in concert with national research systems.

### **CIP**

#### **Centro Internacional de la Papa**

Apartado 5969, Lima, Peru. Founded 1970.

To contribute to increased food production, the generation of sustainable and environmentally sensitive agricultural systems and improved human welfare by conducting coordinated, multi-disciplinary research programs on potato and sweetpotato, carrying out worldwide collaborative research and training, catalyzing collaboration among countries in solving common problems and helping scientists worldwide to respond flexibly and successfully to changing demands in agriculture.

### **IBPGR**

#### **International Board for Plant Genetic Resources**

Via delle Sette Chiese 142, 00145, Rome, Italy.

Founded 1974. To encourage, support and engage in activities to strengthen the conservation and use of plant genetic resources worldwide, with special emphasis on developing countries by undertaking research and training and by providing scientific and technical information.

## **ICARDA**

### **International Center for Agricultural Research in the Dry Areas**

P.O. Box 5466, Aleppo, Syria. Founded 1975.

To meet the challenge posed by a harsh, stressful and variable environment in which the productivity of winter rainfed agricultural systems must be increased to higher sustainable levels; in which soil degradation must be arrested and, possibly, reversed; and in which water use efficiency and the quality of the fragile environment need to be ensured.

## **ICLARM\***

### **International Center for Living Aquatic Resources Management**

P. O. Box 1501, Makati, Metro Manila, Philippines.

Founded 1977. To improve production and management of aquatic resources for sustainable benefits of present and future generations of low-income users (producers and consumers) in developing countries through international research and related activities and in partnership with national agricultural research systems by improving the biological, socioeconomic and institutional management mechanisms for sustainable use of aquatic resource systems, by devising and improving production systems that will provide increasing yet sustainable yields and by strengthening national programs to ensure sustainable development of aquatic resources.

*\*Admitted to the CGIAR in May, 1992.*

## **ICRAF**

### **International Centre for Research in Agroforestry**

P.O. Box 30677, Nairobi, Kenya. Founded 1977.

To mitigate tropical deforestation, land depletion and rural poverty through improved agroforestry systems.

## **ICRISAT**

### **International Crops Research Institute for the Semi-Arid Tropics**

Patancheru P.O., Andhra Pradesh 502 324, India.

Founded 1972. To foster, facilitate and conduct research on selected crops (sorghum, millet, chickpea, pigeonpea and groundnut), resource management, technologies and institutions; to increase the productivity, versatility and stability of these crops and suggest appropriate ways of fitting them into

existing and improved farming systems; and to emphasize a more judicious use of natural and human resources in partnership with national agricultural research systems.

## **IFPRI**

### **International Food Policy Research Institute**

1200 Seventeenth Street, N.W., Washington, DC 20036-3006, USA. Founded 1975. To focus on

identifying and analyzing policies for meeting food needs of the developing countries, particularly the poorer groups within those countries. Research covers ways to achieve sustainable food production and land use, improve food consumption and income levels of the poor, enhance the links between agriculture and other sectors of the economy and improve trade and macroeconomic conditions.



## **IIMI**

### **International Irrigation Management Institute**

P.O. Box 2075, Colombo, Sri Lanka. Founded

1984. To strengthen the development, dissemination and adoption of lasting improvements in the performance of irrigated agriculture in developing countries.

## **IITA**

### **International Institute of Tropical Agriculture**

PMB 5320, Ibadan, Nigeria. Founded 1967. To

contribute to sustainable and increasing food production in the humid and subhumid tropics and thereby to improve the well-being of low-income

people by conducting international agricultural research and outreach activities in partnership with African national agricultural research systems, particularly on maize, cassava, cowpea, plantain, soybean and yam.

#### **ILCA**

##### **International Livestock Centre for Africa**

P.O. Box 5689, Addis Ababa, Ethiopia. Founded 1974. To strengthen the ability of national agricultural research systems to conduct technical and policy research in livestock-related fields, to develop technical packages for increasing livestock production and the contribution of livestock to sustainable agricultural production and income and to contribute to scientific knowledge in a way conducive to solutions to livestock production problems.

#### **ILRAD**

##### **International Laboratory for Research on Animal Diseases**

P.O. Box 30709, Nairobi, Kenya. Founded 1973. To serve as a world center for research on ways and means of conquering, as quickly as possible, major animal diseases (trypanosomiasis and tick-borne diseases) which seriously limit livestock industries in Africa and in many other parts of the world.

#### **INIBAP**

##### **International Network for the Improvement of Banana and Plantain**

Parc Scientifique Agropolis, Bat 7-Boulevard de la Lironde, 34980 Montferrier-sur-Lez, France. Founded 1984. To increase the productivity and stability of banana and plantain grown on small-holdings by initiating, encouraging, supporting, conducting and coordinating research; by strengthening national and regional programs and facilitating the interchange of improved and disease-free genetic material; by coordinating and supporting the collection and exchange of documentation and information; and by coordinating and supporting training for researchers and technicians from developing countries.

#### **IRRI**

##### **International Rice Research Institute**

P.O. Box 933, 1099 Manila, Philippines. Founded 1960. To improve the well-being of present and future generations of rice farmers and consumers,

particularly those with low incomes, by generating and disseminating rice-related knowledge and technology of short- and long-term environmental, social, and economic benefit and by helping to enhance national rice research systems.

#### **ISNAR**

##### **International Service for National Agricultural Research**

P.O. Box 93375, 2509 AJ The Hague, The Netherlands. Founded 1979. To assist developing countries in bringing about sustained improvements in the performance of their national agricultural research systems and organizations by supporting their efforts in institutional development, by developing or adapting new management technologies, by strengthening managerial skills and by generating and disseminating knowledge and information.



#### **WARDA**

##### **West Africa Rice Development Association**

01 B.P. 2551, Bouake 01, Cote d'Ivoire. Founded 1970. To conduct and promote research to improve the technical and economic options available to smallholder farm families in the upland/inland-swamp continuum, the Sahel, and the mangrove swamp environments by developing improved rice varieties and production methods, by reducing postharvest losses, by assessing and increasing the acceptability and impact of new technology and by investigating issues affecting technology adoption and analyzing national policy options.

## The Year in Review



ICRAF / Anthony Njenga

*Chagga homegarden in the Mount Kilimanjaro region of Tanzania with coffee, banana and trees in the upperstorey and maize and taro in the understorey.*

The CGIAR looked back on two decades of experience and looked forward toward the challenges that lie ahead as it entered its 21st year. The 20th anniversary of the CGIAR fell on May 19, 1991, on the eve of the Group's mid-term meeting held in Paris. A formal commemoration took place during International Centers Week (ICW91), the annual meeting in Washington, D.C.

The commemoration took the form of a public symposium, under the umbrella of the Sir John Crawford Memorial Lecture,<sup>1</sup> at which CGIAR Chairman Wilfried P. Thalwitz and representatives

of the Ford Foundation (Mr. E. Walter Coward, Jr.) and Rockefeller Foundation (Mr. Robert W. Herdt) were the speakers. Mr. Derek E. Tribe of Australia's Crawford Fund for International Agricultural Research presided.

The two Foundations were described as the parents responsible for the conception of the CGIAR system. Other eminent individuals from the FAO, UNDP and the World Bank—cosponsors of the system—were the “midwives” whose skill and experience brought the CGIAR baby into existence. Their successors nurtured the infant into adulthood.

Honored for their invaluable contribution to the growth of the CGIAR system were the scientists who so ably led research on which the green revolution was built; individuals who laid the tra-

<sup>1</sup>The annual lecture has been sponsored by the Australian Government since 1985 in honor of Sir John Crawford (1910–1984), first chairman of the CGIAR Technical Advisory Committee



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## ***CIP: Potato Possibilities***

The potato has the distinction of being one of the most difficult of the major food crops to multiply, store or transport. It is also extremely susceptible to insects and diseases and is a top user of chemical pesticides. Even so, it is currently one of the fastest growing food crops in developing countries.

Its popularity is based on its excellent yields (up to 70 t/ha), its high return on investment over short periods of time and an unusual capacity to adapt to vastly different growing conditions. However, the crop's ability to fit into farming systems with high-yielding, short duration cereals has served as a major catalyst for increased production.

According to CIP economist Gregory J. Scott, over 50 million tons of potatoes will be harvested this year in Asia alone. Since the 1960s, Asian potato production, he says, has increased 165 percent; area planted by nearly 90 percent; and

yields by more than 40 percent. In India output has increased 330 percent over the past 30 years; in Bangladesh, production has doubled twice in just three decades.

Because of its short vegetative cycle, a crop of potatoes can be easily grown between two cereal crops. Improved wheat and rice varieties, Scott notes, have also served as an incentive for improving irrigation systems. This, in turn, enables farmers to grow potatoes during the off-season when water is scarce.

In addition, many Asian countries have literally brought potato production down from the hills by introducing seed schemes into the lowland areas, thus moving the source of supply closer to the consumer. This, Scott says, has helped to reduce post-harvest losses, cut transportation costs and make available a fresher and more affordable product to the urban and rural poor.

Hubert Zandstra, CIP's Director General, notes that in the past the center has backstopped national potato programs through germplasm exchange, networking and training. A major effort has also been made to reduce dependence on chemical pesticides by introducing environmentally safe pest management schemes. "Our strategy has been to help national systems expand production and make it sustainable" he says.

The CIP program for the 1990s, Zandstra adds, places renewed emphasis on natural resource management, marketing, policy development and postharvest. "We are also putting a high priority on information systems so that the experience in places like Asia can be made available to national programs wherever the potato can help feed hungry people."



*CIP personnel conduct a potato training course in Viet Nam.*

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ditions of service to the hungry and poor to which the system continues to be fully committed.

Although the record of the CGIAR is substantial, its investment in agricultural research is only a fraction of the total amount spent globally. In 1991, the total annual core budgets of CGIAR centers was approximately \$237 million. Total annual expenditure by all agencies, public and private, on agricul-

tural research in developing countries is \$2,245 million. Global annual expenditures on agricultural research amount to more than \$10 billion.

The lessons of experience suggest that the achievements of the CGIAR with relatively lean expenditures were made possible by its founding characteristics which turned out to be effective and long lasting.

The CGIAR was established to consolidate and extend the initial gains of agricultural technology (the green revolution) that changed the food situation in Asia. The vision of the founders was of a world order where food production would be the entry point through which the application of science could change the lives of the poor. Then as now the central focus of the CGIAR was on research.

A unique characteristic of the CGIAR is its capacity to provide collective support for a widely spread network of international research centers without centralized decision-making authority. This requires an unusual level of commitment, as well as a capacity for consensual decision making. Both qualities are rare elsewhere.

The creation of the CGIAR was a response by donors to the challenge of channeling science to meet the needs of the world's hungry, and donors have "kept the faith" ever since. The number of donors has increased, as has the number of centers. The involvement of three multilateral institutions as cosponsors has strengthened the international character of the Group, giving it a capacity to deal with global issues.

The role of the World Bank as the donor of last resort has provided the CGIAR system with stability and integrity. For its part, the CGIAR has created technologies for developing countries consistent with the goals of the Bank, other development agencies and developing countries themselves.

The independence and international character of the centers have enabled them to develop as true "centers of excellence." The quality and relevance of their work is universally recognized. Close to 2,000 scientists representing over 60 nationalities work at CGIAR centers.

Because they are non-political, the centers are able to approach research issues on their own merits, not in terms of interests external to their responsibilities. They have maintained a flexibility that has enabled them to make course corrections when these are necessary, to move into new areas of research in response to situations requiring special attention and to experiment successfully with new forms of research.

The review, advisory and executive mechanisms established by the founders of the CGIAR have given the CGIAR system self-confidence, high standards and a sense of accountability. Not surprisingly, the "CGIAR model" is recommended for adoption or adaptation in many other areas,

e.g., child vaccine research, energy, the environment, general health, science and technology.

Many challenges lie ahead, however, including that of matching productivity concerns with natural resource management.

As the CGIAR Chairman said at the 20th anniversary commemoration, "...on the food production side, the challenge is how to increase output for growing populations when we know it will have some environmental impact. The CGIAR will have to let itself be measured by the contribution to preserving the natural resource base on which future production depends, in the identical manner that it is measured by the extent to which its work helps to feed the world's hungry."

"The sometimes maligned plant breeding activity, and even the newest methodologies of biotechnology (suitably guarded with care for biosafety), will have to make their contribution to meeting the productivity objective."

"Where else, when you do not want to press in on marginal land too much more; where else, when power generation for irrigation pumps and the manufacture of fertilizer have their own environmental limitations; where else, but in breeding, with a lot of environmental concerns put into the goal formulation of breeding, will you get the yield increases without creating larger environmental problems elsewhere?"

"The measure of environmental commitment and success lies in the total permeation of all other activities by the imperative of resource conservation—whether it is commodity research, whether it is farming research or assistance to national agricultural research systems in developing countries."

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## CGIAR Priorities

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It was against the background of satisfaction gained from past achievements laced with confidence in its capacity to grapple with the tasks of the present and the future that the CGIAR began the process of reviewing its priorities, as it is committed to do every five years. Priorities were last revised in 1986, making 1991 the next date for the priority-setting exercise. The process was delayed, however, because from 1988 the CGIAR was expanding into agroforestry/forestry research, irrigation management and research into "new" commodities. A review of priorities commenced

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## ***CIMMYT: Assessing the Impact of New Maize and Wheat Technologies***

Blending altruism and self interest, support for the CGIAR favors efforts on behalf of the poor, especially women and children and the environment. Economic growth and the protection of natural resources are seen as the primary means for resolving these concerns. CIMMYT's work on productivity increasing technologies, on protecting agriculture's natural resources and on strengthening national research systems relates directly to these areas.

In particular, productivity increasing technologies reduce the real cost of basic food and, with everyone a consumer, both lubricate the growth process and ameliorate hunger. Their lower production costs increase incomes in agriculture, making the sector itself a source of growth. And their resulting greater production reduces the urgency of tilling fragile lands and forests, providing indirect protection to natural resources. Such technologies, then contribute powerfully to the aims of the CGIAR's donors.

Recognizing this, on the eve of its 25th anniversary, CIMMYT initiated a study to assess the impact on productivity of its collaborative efforts with national systems. As with the diffusion of new

germplasm, national agricultural research systems played a central role in the study. Study results are the basis for the following observations.

### **Maize Highlights**

- About 75 percent of the open-pollinated varieties (OPVs) and hybrids released in developing countries (excluding China) between 1985 and 1989 and about half those released since 1965 contained germplasm improved by CIMMYT.

- These materials cover 8 million hectares, 13 percent of the non-temperate maize and 30 percent of the area under improved varieties. These developments rest on close collaboration between CIMMYT and national systems.

- Most are adapted to the tropical lowlands.

- Improved materials are now available for the subtropics, mid-altitudes and tropical highlands, and major increases in varieties released there are expected.

- Given the earlier relationship between release and adoption, a notable increase in the area under maize related to CIMMYT's work is expected in the near future.

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in 1991, however, based as before on options presented to CGIAR members by the Group's Technical Advisory Committee (TAC).

The Committee outlined five activities and suggested the proportion of CGIAR resources that should be invested in each category by the year 2010: conservation and management of natural resources including germplasm conservation—20 percent (up from 15 percent in 1989); germplasm enhancement and breeding in agriculture, forestry and fisheries—25 percent (25 percent); development of sustainable production systems for agriculture, forestry and fisheries—25 percent (35 percent); socioeconomic, public policy and public management research—10 percent (5 percent); and strengthening national research systems including training, information and institution building—20 percent (20 percent).

In its analysis of research priorities by agro-

ecological zones, TAC suggested that the main emphasis in agricultural research should be on tropical agroecologies and on the cool subtropics with "winter" rainfall. For forestry, TAC proposed that relative emphasis should increase for tropical agroecologies in general.

The appropriate balance of CGIAR efforts among agriculture (crops and livestock), forestry and fisheries was reviewed. Further analysis had to be undertaken because agroforestry/forestry research was only recently added to the CGIAR agenda, and work on fisheries had yet to be finally agreed upon. TAC's analysis suggested, however, that critical research needs in crops and livestock should not be neglected in the effort to build up agroforestry/forestry and fisheries programs.

Within the agriculture sector, TAC presented an examination of 27 commodities (crops and livestock). These included 16 commodities that are

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## Wheat Highlights

• By 1990 wheat varieties directly associated with CIMMYT's work occupied 70 percent of the developing world's wheat area (outside China) and accounted for 80 percent of the production.



CIMMYT / Kathryn Elssesser

*Grain for sale at a market in Ethiopia.*

• The area continues to increase, expanding by some 20 million hectares in the 1980s.

• A steady 50 percent of the varieties released in the 1980s came from crosses made in Mexico followed by rounds of selection there.

• Initially grown only in favored regions, the materials are now advancing into drier and less favored environments.

• With the first semidwarfs as the base, the yield plateau has increased at about 0.7 percent per year, with accompanying major improvements in disease resistance, and, lately, drought and heat tolerance.

These new maizes and wheats have added appreciably to productivity in agriculture. A noteworthy example is the case of India where, in the face of a twofold increase in utilization and with only modest imports, wheat's real price to consumers has fallen by 40 percent since the late 1960s. Without variety-based, productivity-increasing technologies, population increases alone would have put inexorable pressure on fragile lands and forests and on the prices of staple foods, limiting economic growth. These results suggest that investment in CIMMYT's work has had gratifyingly high returns.

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already on the CGIAR agenda (such as rice, wheat, cassava, sheep and goats, potato, beans) and 11 "new" commodities. A priority portfolio of commodities was finally defined in consultation with national agricultural research systems in developing countries.

The first round of discussion on the options proposed led to broad agreement on a number of themes such as:

- reaffirmation of the role of research;
- agreement that research programs should be equally concentrated on specific commodities, on natural resource management, sustainability and related concerns;
- the need to strengthen CGIAR relationships with national agricultural research systems while taking into account the limitations of the CGIAR in this area; and

• the relationship between conducting research on priorities and the flow of financial resources.

In more specific terms, the following points were made:

**Research.** The CGIAR system is research-oriented and should continue to support strategic agricultural research on issues of transnational importance.

**National Systems.** Strengthening linkages between international centers and national agricultural research systems was identified as a priority. In this connection, there was general agreement that the application of a number of key principles would bring clarity into the relationship between CGIAR and national systems: International centers should assist national research systems through networking and training. CGIAR centers should plan an appropriate devolution of research func-

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## ***IIMI: On-Farm Water Management***

A. K. Kirigoris is a happy farmer. For the first time in 30 years, he obtained sufficient irrigation waters to cultivate the full extent of his 2.5 acres of paddy lands located at the tail-end of Field Canal 4, Moreketiya DC 7 of the Uda Walawe Irrigation System in Sri Lanka. The result was a bumper harvest of 280 bushels, a 150 percent increase over his 108 bushels in previous seasons.

Fifty-four year-old Kirigoris, married with seven children, came to Uda Walawe in 1962 lured by the promise of land and water, making the long trek from his ancestral village of Lumana in the southern district of Hambantota. A paddy cultivator like his fellow settlers, Kirigoris' sole source of income is from the two crops of paddy he cultivates every year.

"There is sufficient water for all," he says "this is a relatively water abundant system, but selfish practices by farmers and inefficient distribution of water by the agency favor some and deprive others. Every season there are disputes over water, sometimes even violence. In 1982, a neighboring farmer in FC 5, also a tail-ender like me, was hacked to death in a fight over water."

Kirigoris attributes his change of fortune to the formation of the DC 7 Farmer Organization initiated in his canal system by IIMI and its national collaborative partner, the Mahaweli Economic Agency (MEA) of the Mahaweli Authority of Sri Lanka. "Our organization," says Kirigoris, "provided an efficient and effective mechanism for the implementation of MEA/IIMI on-farm management practices which resulted in my bumper crop."

MEA and IIMI adopted a "bottom to top" approach when organizing and training farmers. MEA and IIMI field staff visited each of the 79 farmers in DC 7, organizing them into groups at field canal level. IIMI staff assisted farmers to draw up a constitution, elect officials and arrange a meeting place. MEA and IIMI also provided each group with a one-day training session. Kirigoris was elected Farmer Representative by his field canal group, FC 4, and currently represents them on the Committee of the Moreketiya DC 7 Farmer Organization.

The Moreketiya DC 7 Farmer Organization

then went on to successfully take over the maintenance of the distributory which involved desilting, weeding and maintaining the design profile of the canal. Farmers also began to participate actively in water distribution operations. By ensuring that the required quantity of water was delivered at a



*The rehabilitated distributory canal, Moreketiya DC 7, which carries water to Kirigoris and other farmers in his unit.*

specified location at the time it was needed and by keeping farmers informed of water delivery schedules, a 50 percent saving of water was achieved without irrigation difficulties. Water was then distributed to farmers who previously had been deprived.

"Not only has my yield and income increased, now I can sleep nights," said Kirigoris. "No more illegal night irrigation!"

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## ICRAF: Agroforestry Abates Erosion

In their search for land, farmers everywhere in Africa are forced to cultivate steeper and steeper slopes, leading to soil erosion and siltation of waterways. Ironically, erosion caused by rainfall is often most severe in dry areas. Here, a large part of the total rain for the year may fall in two or three violent tropical storms. Vegetation cover tends to be sparse and heavy rainfall can lead to dramatic soil losses—making what was already a difficult farming situation even worse.

ICRAF has been testing agroforestry's soil conservation potential since 1984 at the Machakos Research Station in Kenya's semiarid zone. Low hedgerows of *Cassia siamea*, a leguminous shrub from Asia, planted on the contours have led to the natural formation of micro-terraces on land sloping at 14 percent. The hedges take up much less space than conventional conservation structures, leaving more land available for crop production.

The real test came one night in April 1990 when 52 millimeters (2 inches) of rain fell in just 30 minutes on slopes that were already saturated. Fields with only crops lost more than 34 tons of soil per hectare, while fields with hedgerows lost at most 6 tons per hectare and many lost less. The effect of the storm on subsequent crop production was also striking. Where maize and cowpeas were grown between hedgerows, they produced two to three times the harvests from fields with crops alone.

Again in December 1991, 52 millimeters of rain



ICRAF / Anthony Nyenga

*Natural terrace formation behind a hedgerow of *Alnus nepalensis* interplanted with wheat on steeply sloping land at Rwerere, Rwanda.*

fell in one storm, this time in 90 minutes. Soil loss from fields with only maize and cowpeas was nearly 5 tons per hectare, while loss from fields with hedgerows was less than 1 ton per hectare. In some cases no soil was lost at all.

ICRAF and national researchers have now begun testing contour-aligned hedgerows on hillsides in the highlands of Uganda and Rwanda. Here farmers cultivate food crops on slopes as steep as 45 percent. Of several different hedgerow species, *Croton megalocarpus*, a local multipurpose tree, has shown particular promise. Results are preliminary, however, terraces are already forming and there are clear signs that erosion is being reduced.

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tions to national systems that can take over tasks of international significance.

However, it had to be recognized that funding which could be diverted by CGIAR centers to developing national research systems was minute in comparison to the needs of those institutions. International centers and national systems, meanwhile, need to strengthen a two-way relationship in which agenda formulation at the international level recognizes the tasks and problems of national institutions.

**Ecological Issues.** Strong support was forthcoming for the need to meld an emphasis on natural resource management into the research

agenda. This did not mean, however, that the emphasis on productivity-oriented commodity research should diminish. Each should be as strong as the other.

**Commodities.** A research focus on food commodities of importance should continue. There are a set of major cereals that are critically important on the global scene particularly to developing countries. The CGIAR should be cautious about significantly altering the commitment to those crops until alternate sources of supply were identified and fully understood.

The CGIAR system could explore further whether it should maintain a priority for commodi-

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## ***IITA: Less Work, More Income***

Processing technology can determine by how much cassava growers will benefit from their labor. Well-designed equipment in a well-organized system can significantly improve farm families' income from their cassava harvest, as IITA found with its Moniya project in Oyo State, Nigeria during 1990-91.

Research and development of postharvest technology is a broad subject covering all operations in processing, storage and utilization of a food crop. In cassava processing, the initial challenges are to solve the problems of product loss, high labor input and poor product quality. Potential gains from research hold a special significance for the well-being of farm women and their families, because cassava is processed in Africa largely by women. Postharvest losses as a whole can exceed 40 percent of the harvested crop; half of those losses occur in processing operations. Processing also requires more working time than harvesting and handling operations. The processing labor input is estimated at 82 person-days for a harvest of 10 tons. More than 80 percent of that time requirement is met by women and children.

Since 1988 IITA has developed an equipment package for the main stages in cassava processing,



IITA / Moyo Bolam

*Technicians demonstrate operation of an IITA-designed cassava grating machine.*

which includes a peeling knife and peeling bay, machines for grating, dewatering, chipping, fermenting, drying, grinding and sifting cassava and a stove with fryer. Each of these has been

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ties of subsidiary importance, or whether responsibility for research into those commodities should devolve to other research systems.

**Regions.** There are research needs of an international character in each of the regions surveyed by TAC. Agreement was not reached, however, on the relative weight that should be given to each region. In particular, divergent views were expressed as to whether or not the CGIAR should increase its research efforts in Africa—to the possible detriment of programs elsewhere.

**Continuity.** As a dynamic organization the CGIAR system should be sensitive to changing needs and trends, but research programs would suffer if they were buffeted by political winds that changed course periodically.

The system had to define a balance between

responsiveness to emerging trends while simultaneously protecting the valuable intellectual capital which the CGIAR has invested in the centers. That form of capital was the basis on which centers could adjust to changing trends and demands.

**Financial Resources.** A thread running through the entire discussion was the issue of guaranteeing or maintaining funds for research, the continuing diminution of Overseas Development Assistance funds, and the need to match resource supply with demand.

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## **Green Revolution**

Worldwide interest in the “green revolution,” which was based on high-yielding varieties (HYVs) developed by CIMMYT and IRRI, the

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tested in pilot locations in Nigeria. Designs are modified during field tests to adapt the equipment to the work setting and with the help of the end users for each selected community, thus enhancing the utility of the various machines.

Selection of the pilot test locations was based on local needs or problems, which were first assessed in a comprehensive survey. Interviewers were locally recruited and trained. They kept records of available equipment, system capacities and operational requirements, among other data. Family information and community profiles were recorded, including income sources, crops and areas planted, production potential, expenditures and activities other than farming. This information is later used in assessing technology impact or the quality of life before and after the technology is introduced.

A group of more than 50 women at the village of Moniya, who call themselves the “Stop Hunger” group, have set up a community center for processing cassava. Their aim is to improve the quality of the food they and their families consume, and to reduce the time they must spend in processing cassava.

The Moniya group operate the center essentially

as a food exchange scheme, taking on some contract processing as well. Farmers give their fresh cassava tubers to the center in exchange for processed cassava. The productivity gains from the community effort have been amazing—from 50 kilograms of cassava tubers, the center processes 13 kilograms of *lafun* (flour) or 10 kilograms of *gari* (fermented meal) with IITA-designed equipment and training. Under traditional processing by individual effort, 50 kilograms of tubers yields only 9 kilograms of *lafun* or 6 kilograms of *gari*.

To cover its operational costs, the Moniya center retains 3 of the 13 kilograms of *lafun* or 3 of the 10 kilograms of *gari*. The customer benefits with 1 kilogram extra of either product than he or she could have produced under traditional processing and without having to do the work. The manager of the center, who must devote full time to the operation, can take on private processing work during the afternoons to earn personal income.

Success in the enterprise has brought favorable changes in the quality of life for the Moniya community. The environment around individual homes and the work center is cleaner and less smoky, and the villagers have more time to spend on income-generating activities.

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pioneer institutes of the CGIAR system, was renewed in 1991, when the World Food Council (WFC) urged the international development community to commit itself to a “renewal of the green revolution” so that developing countries could achieve food security.

The call for a renewal of the green revolution reaffirmed the contribution made by international agricultural research to agricultural development and thus to the well-being of people in disadvantaged countries.

Not many years ago pessimism about the capacity of emerging post-colonial nations to feed themselves was often accepted as a matter of tragic inevitability. Access to food was as limited as access to other necessities. Some policymakers felt that the only way in which the newly independent countries could be fed was by food aid. A limit-

less line of ships should link the grain producing countries of the west with newly independent countries across the seas, carrying cargoes of food and peace, they said. This was a well-motivated argument based on the unwillingness of its supporters to see large masses of human beings starve, sicken and die.

Other assessments of the situation were more stark, and less hopeful. The pragmatic virtues of a “triage approach” were seriously examined. Nothing could ever really help these masses of people, some very thoughtful people believed. They would starve to death. The green revolution challenged those judgements.

The phrase “green revolution” was coined by Mr. William S. Gaud, a former Administrator of the U.S. Agency for International Development (USAID). The term was applied to South Asia’s



## ICARDA: Soil Erosion Strategies

Soil erosion by wind occurs where natural vegetation, particularly trees, shrubs and other perennial species, has been removed and not replaced by any other form of protection. Planting of such shrubs as

erosion and provides feed for livestock. ICARDA, in collaboration with the Syrian Government and the Arab Center for Studies of the Arid Zones and Dry Lands (ACSAD) is measuring the productivity of shrub vegetation at three levels of livestock (sheep) stocking intensity. Herbage production of improved pasture from its natural seed bank and from shrubs was more than doubled that of unimproved pasture, and it supported the livestock for several months longer.

Farmers may, however, see planting shrubs as less attractive than the quick returns from planting barley. ICARDA is investigating the effects of shrub hedges on barley and feed legumes grown in strips between them, as well as the productivity of the hedges as feed. This system is comparable with alley farming developed by IITA.

Traditionally, for hundreds of years, farmers in the drier areas of West Asia and North Africa have practiced rotations that leave the land fallow for a year after it has been cropped, usually to barley. Replacement of fallow with suitable food or feed crops has been a subject of great interest to ICARDA. This will not only increase productivity but also reduce erosion and help ensure sustainability. Medic has been found to be a successful pasture legume to replace fallow, and the spe-

record-breaking harvests of wheat and rice in the late sixties. Its use became widespread internationally after Norman Borlaug, whose research produced the high-yielding, semidwarf wheats, which were the basis of those harvests, was awarded the Nobel Prize in 1970.

The increase in productivity which began with the harvests associated with the green revolution, turned the food situation around in much of Asia—before then, considered a “basket case” with only a past, barely a present and without a future. To cite just one example of change: in the mid-



*Medic pasture regenerates after seeds have lain dormant during a cereal crop.*

cies adapted to some of the environments in the region have been identified. These species do not need to be resown after the initial year; they regenerate because their seeds lie dormant during the cereal years. Not only does this save farmers the expense of resowing, but it allows a higher rate of reseedling than farmers could afford. The pasture establishment takes place rapidly and allows a longer grazing period.

ICARDA is also investigating the possibility of using amphicarpous (producing fruits more than once) vetches and chicklings for developing ley farming systems, similar to those with medics, because these vetches and chicklings also produce underground seeds that remain dormant.

1960s, India was considered famine-prone. In the mid-1980s, India, with its worst drought of the century, suffered no famine even in that crisis.

What happened in the green revolution countries of Asia is dramatic, given the starkness of what it replaced, and the forecasts of devastation that it forestalled. But it was not unique. The world as a whole has been witness to continuing increases in productivity. As New York Times reporter William Stevens puts it: “The farmers of the world, harvesting the abundant crops of the green revolution, have so far defied Malthusian

## ***ILCA: Trypanotolerant Cattle***

Trypanosomiasis, a disease transmitted by the tsetse fly, restricts livestock production in much of the better-watered areas of tropical Africa. Fortunately, several African cattle breeds show tolerance of this deadly disease. Until recently, little was known of the performance of these trypanotolerant breeds, and less was known about breeding to improve tolerance. Recent research under the African Trypanotolerant Livestock Network, coordinated by ILCA, has opened up possibilities for breeding cattle that are both more productive and more trypanotolerant.

The signs of trypanosomiasis infection are the presence of trypanosomes in the blood and anaemia, caused by the destruction of red blood cells by the parasites. Research has shown that key indicators of trypanotolerance are the abilities to limit the number of parasites in the blood (parasitaemia control) and to maintain relatively high levels of red blood cells when infected by trypanosomes (anaemia control).

Previous work by members of the African Trypanotolerant Livestock Network has shown that the degree of anaemia in trypanosome-infected cattle, as measured by the packed red cell volume (PCV) in the blood, is correlated with such production traits as reproductive performance and growth—animals able to maintain high PCV levels are more productive than those with low PCV values.

Studies in 1989 demonstrated that an animal's ability to maintain high PCV levels when infected with trypanosomes is a heritable trait, and identified conditions for field testing to assess trypanotolerance levels. This opened the way for practical breeding programs aimed at producing cattle that are both more trypanotolerant and more productive. Such breeding programs are currently being evaluated at Mushie Ranch in Zaire.

While the degree of anaemia is relatively simple to measure, determining the degree of parasitaemia has proven more difficult. In the past, this depended on observation of trypanosomes in peripheral blood using conventional parasitological techniques. However, there is evidence that animals may be infected even when trypanosomes cannot be found by these techniques.

In 1990, this problem was overcome by using an enzyme-linked immunosorbent assay (ELISA) test for trypanosomes developed by ILRAD. This test demonstrates the presence of trypanosome antigens in the blood, an indication of infection. Animals that tested positive with the ELISA test but exhibited no trypanosomes with the parasitological test were termed "antigenaemic." This was taken as a sign that the animal was better able to control parasite development than an animal in which trypanosomes were found.

A trial at the OGAPROV (Office gabonais d'amélioration et de la production de viande) ranch in Gabon showed that parasitaemic animals had significantly lower average PCV and daily weight gain than antigenaemic animals. There were no differences in these characteristics between antigenaemic and non-infected animals. There were indications from this work that ability to control parasitaemia may also be inheritable.

The ELISA test thus offers, for the first time, a practical means of identifying animals with a superior ability to control parasitaemia, providing the opportunity for selection based on this criterion as well as on that of anaemia control.



*Trypanotolerant N'Dama cattle—new results increase the feasibility of selecting for greater trypanotolerance and increased productivity.*

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## ***IRRI: Food for Half the People of the World***

A bowl of rice—that means food for half the people of the world. For three decades, IRRI research has helped 600 million more people to have their daily rice. Now IRRI is focusing on present and future generations of farmers and consumers, particularly those with low incomes, for the rice to be needed by 1 billion more people at the beginning of the new century.

Since 1988, 17 countries have released more than 50 national rice varieties that originated from IRRI breeding lines. There is a breakthrough in IRRI's search for irrigated tropical hybrid rice. Tests in seven countries confirm yield potentials that are 15 to 20 percent higher, equaling those of temperate regions of China. Seed yield is now almost two tons per hectare.

Rice is important to farmers in the often disadvantaged uplands ecosystems. IRRI researchers are collaborating on technologies to make upland rice sustainable and help avoid slash-and-burn practices.

Biotechnology that crosses disciplines is a key element of IRRI's future. Strategic research is being shared among institutions in industrialized countries and with IRRI's national research partners in Asia, Africa and Latin America. IRRI's

innovative genome mapping is a component of the Rockefeller Foundation's rice biotechnology program.

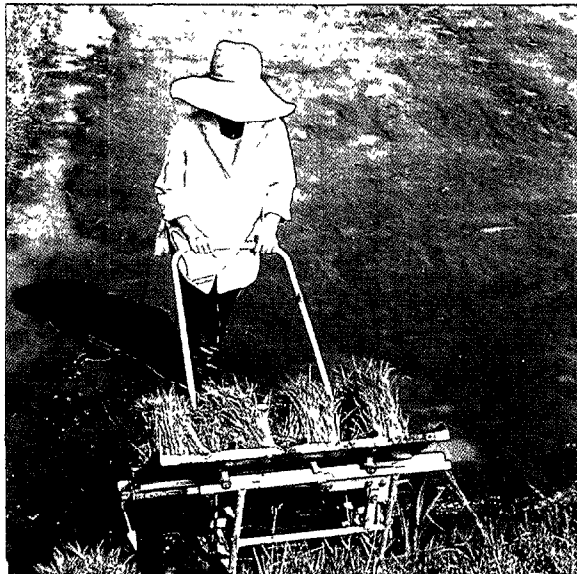
New IRRI machines are leading to labor-economic systems for producing rice. A direct seeder lessens the drudgery of transplanting seedlings; a stripper harvester reduces grain losses. Machines are developed to meet the needs of women who share 50 percent of the labor related to the production of rice. During the past four years, 700 small, private companies received 3,000 design sets to make IRRI machines economically available to farmers.

Rice researchers are seeking environmental breakthroughs. One approach is to develop nitrogen-fixing nodules on plant roots. Another is to reduce methane emissions from flooded rice fields, which may contribute as much as 20 percent to global warming, without reducing crop yields. The U.S. Environmental Protection Agency, the United Nations Environment Programme and the Fraunhofer Society of Germany are collaborating.

IRRI is strongly committed to integrated pest management (IPM). Improper application and misuse of pesticides in rice are all too common. IRRI studies in the Philippines show this can raise farmers' health costs, reducing the value of their increased production. With IPM, farmers can maintain rice yields while reducing costs of unneeded inputs and improving their quality of life.

IRRI is changing the way rice research is carried out by developing partnerships for knowledge sharing instead of technology transfer. Training programs are being given by national staffs. Cambodia is rebuilding its rice research system with know-how from IRRI and financial support from Australia. The newly built Philippine Rice Research Institute is now a partner in much of IRRI's research in its home country.

The word rice can be an acronym for IRRI's theme: Research in Critical Environments. The research of IRRI and its national partners is directed to sustainable productivity in the rice-growing ecosystems, thus helping farmers to produce the daily bowl of rice needed to feed the world's billions in the next century.



*With an ultralite rice transplanter that weighs just 13 kilograms, a woman can transplant rice five times faster than she could by hand.*

predictions that population growth would outrun agricultural production and consign much of humanity to chronic famine.... Famine caused by under-production has largely disappeared; hunger today is mostly a product of political upheaval, bad administration of food supplies or the inability of the poor to buy food.”<sup>2</sup>

And yet, images of hunger surround us. So do warnings that food supplies, even when they are abundant, are always endangered by any number of potentially adverse trends—population growth, environmental degradation or civil war, for example. Moreover, food supplies are unevenly distributed, and the benefits of productivity do not always reach the poor.

So, to say that great advances have been made on the food front is by no means to imply that the world has been fed, the job completed. Much more remains to be done, in terms of increasing food supplies and of ensuring that productivity is not achieved at the expense of the environment.

The WFC’s appeal for a renewal of the green revolution brought these needs to the forefront of the unfinished agenda of international development. This will need a great infusion of resources for agricultural research, and an acceptance of the need to move swiftly. The WFC said, “Hungry people cannot wait for an upturn in global economic fortunes. They have to eat now....”

This approach coincided with the analysis of CGIAR Chairman Wilfried P. Thalwitz in his address commemorating the 20th anniversary of the CGIAR. He said, “...we have been lulled particularly by the discussion in industrialized countries surrounding the GATT (General Agreement on Tariffs and Trade) negotiations into overlooking the productivity issue that exists in the world today. The GATT discussions may make us believe that food is in excess supply, that it is a subject for domestic subsidization, to be pushed out with export promotion and kept out through entry restrictions. None of the above is true for the developing world....”

More than a billion people live in poverty across the globe. This number is expected to increase as the world moves toward an anticipated 7.8 billion in the year 2000. Increased productivity alone will not feed the poor. Lack of income and lack of empowerment add to the problems of the poor and hungry and without adequate food supplies their hopes for the future can only diminish.

Unless yields of major food crops more than double over the next 30 years, malnutrition, even starvation, will be widespread. The problem is particularly grave in Africa where, in the eighties, one out of every four persons lacked the minimum diet for a healthy life—despite food aid.

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## Widespread Impact

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The potential of a “renewed” green revolution to deal with these realities was underscored by compelling evidence that the benefits of agricultural development which began in the sixties reached far and wide. This evidence was provided in a study published in 1991, *The Green Revolution Reconsidered* by Peter B. R. Hazell and C. Ramaswamy,<sup>3</sup> who examined the impact of the green revolution over a decade in North Arcot, in rural South India.

The evidence runs counter to earlier criticisms of the green revolution on the grounds that it helped only rich farmers with large holdings. This theory first surfaced in the seventies when criticism of the green revolution was generally advanced without supporting evidence.

Looking back on those comments, Mr. Haldore Hanson, a former Director General of CIMMYT, says: “...it seems to me that those who castigated the green revolution were more interested in advancing an ideology than in securing an adequate food supply for the third world.”<sup>4</sup>

In fact, the Hazell and Ramaswamy study found that the green revolution helped large farmers, small farmers and wage earners. At first, benefits took a longer time to reach small farmers who experienced initial problems in gaining access to inputs and credit and who had less-assured supplies of water. However, later releases of the new seed were more tolerant of a variable water supply.

Overall, the study found that absolute poverty declined: “The available evidence from the resurvey villages shows that small paddy farmers

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<sup>2</sup> *New York Times*, June 25, 1991

<sup>3</sup> *The Green Revolution Reconsidered: The Impact of High-Yielding Rice Varieties in South India*, Peter B. Hazell and C. Ramaswamy, The Johns Hopkins University Press, Baltimore, Maryland, USA for IFPRI, 1991

<sup>4</sup> *Fifty Years Around the Third World, Adventures and Reflections of an Overseas American*, Haldore Hanson, Fraser Publishing Company, Burlington, Vermont, USA, 1986

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## ***WARDA: Improved Mangrove Rice Varieties***

Since 1976, WARDA has maintained a major regional rice varietal improvement program targeting approximately 200,000 hectares of mangrove swamps that are cultivated to rice in West Africa. With work based at Rokupr, Sierra Leone, WARDA scientists in collaboration with national agricultural research system scientists have screened large numbers of introduced materials, collected, purified and characterized local varieties and carried out large numbers of crosses to incorporate desirable characteristics into improved cultivars. Significant progress has been achieved, as evident from the outstanding performance of the new, improved short and medium duration mangrove rice varieties compared to farmers' best local varieties in several on-farm tests in the region. However, little information has been available on the adoption and impact of these improved varieties.

WARDA conducted a major study in Sierra Leone and Guinea during the 1990-91 crop season to: (1) determine the adoption patterns of the varieties; (2) quantify the factors that determine the adoption behavior of farmers; and (3) estimate the economic impacts of adoption. Major mangrove rice growing areas in the two countries were surveyed over a six-month period from November 1990 to April 1991.

Farmers identified and ranked the ten most important mangrove swamp rice cultivars that they grow. The survey results indicated that three of the improved varieties (ROK-10, ROK-5 and Kuantik Kundur) ranked very high among farmers in Sierra Leone. ROK-5 was ranked in the third position by 20 percent of the respondents; ROK-10 was ranked in the fifth position by 26 percent of the respondents; and Kuantik Kundur was rated in seventh position by 17 percent of the farmers. In Guinea, ROK-5 is the only modern variety of any wide importance and was ranked as the third most important variety by 15 percent of the farmers.

The survey data showed that 52 percent and 17 percent of the sampled households in Sierra Leone and Guinea respectively were growing one or more of the improved mangrove swamp rice varieties mostly in combination with their local varieties. For both countries, the mean share of the total rice area grown by farmers under the improved varieties rose from 9 percent in 1988 to 16 percent in 1990.

Econometric modeling analyses, conducted to determine the factors motivating the adoption of the varieties, show that farmers' perceptions of the superiority of these improved varieties in terms of some specific attributes (e.g., ease of cooking, threshing quality, tillering capacity and yield) are

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(+90%) and landless laborers (+125%) gained the largest proportional increases in family income between 1973/74 and 1983/84.... These changes are corroborated by measured changes in the real value of household consumption expenditure, by a sharp improvement in calorie and protein intake, and by the growing importance of higher quality foods in total household expenditure."

The Hazell and Ramaswamy study is the first to compare the situation in a green revolution area before and after new technology was introduced.

IFPRI, which initiated the study, summarized some of its conclusions as follows:

- The green revolution in North Arcot was modest compared to the dramatic technological

changes observed in areas like Punjab and Haryana. This was due to a lack of reliable water supplies and the pre-existing use of locally improved varieties that already had key physiological features of the high-yielding varieties (HYVs).

- Nevertheless, regional paddy output increased by 57 percent between the mid-1960s and the late 1970s, and this growth had a significant economic impact on the region's villages and towns.

- Furthermore, none of the predictions of the critics—that smaller farmers would be either unaffected or made worse off by the green revolution and that unnecessary mechanization would significantly reduce rural employment, thus worsening absolute poverty—came true.

- The study found that between 1973-74 and



*The research program objectives of WARDA include development and evaluation of improved rice varieties suitable for the West African consumer.*

the major factors determining the adoption of the improved mangrove rice varieties. Surprisingly, the farm and farmer specific factors (e.g., farm size, contact with extension, years of experience of farmers, level of education of farmers, etc.) traditionally shown in the general adoption-diffusion literature as influencing adoption, were

not significant in determining adoption of the improved mangrove swamp rice varieties.

The estimates show that the cumulative farm-level economic benefit (from 1986 to 1990) derived by the smallholder mangrove swamp rice farmers in the Great Scarcies region of Sierra Leone, due to adoption of the modern varieties, ranges from US\$12.2 million to \$14 million. In Guinea, due to the lagged adoption by farmers of the improved varieties (starting mainly in 1990), the cumulative economic benefit to the farmers in the Coyah region is estimated at US\$0.31 million to \$0.4 million. While local varieties yield on average 2.3 metric tons per hectare, the average yield of the improved varieties is 3.5 metric tons per hectare under actual farmer conditions in both Guinea and Sierra Leone.

Estimates show that the share of mangrove rice income that is derived from the improved varieties has increased from 6 percent in 1986 to 28 percent in 1990 in Sierra Leone and in Guinea from 3 percent in 1989 to 13 percent in 1990.

The results from this study show that WARDA's collaborative research with national agricultural research systems is making significant economic impact in West Africa, and is directly benefiting the smallholder mangrove rice farmers of West Africa.

1983-84, not only did an initial gap in HYV adoption between large and small farms disappear, but the gap in yield levels closed as well, providing evidence that green revolution technology is "scale-neutral."

- Small paddy farmers and landless laborers, who were initially among the poorest households, gained the largest proportional increases in family income, virtually doubling their real income during the decade.

- Non-paddy farmers and non-agricultural households increased their real family incomes by 20 to 50 percent.

- The study showed that there were important benefits from the green revolution for the non-farm economy. Each rupee increase of value added in

agriculture stimulated an additional Rs.0.87 of value added in the region's non-farm economy.

- About half of this indirect income gain was due to agriculture's demands for inputs and marketing and processing services, and the rest was due to increased consumer demands as a consequence of higher incomes.

Moreover, continuing reviews of agricultural development in "green revolution countries" has demonstrated that the impact of the new varieties of rice and wheat continues up to today, and will do so into the future.

As a report prepared for the WFC by the CGIAR Secretariat pointed out, there are four dimensions to the continuous evolution and impact of the green revolution. Farmers using the new

technology obtain repeated benefits year after year. Adaptations by scientists of seed varieties to local conditions raise yield ceilings further. Adaptations benefit farmers who grow crops in soil and water conditions different from those in which the first generation of new varieties were cultivated. Adaptation allows extension of the crop to areas previously unsuited to it, bringing new crop opportunities to more farmers.

In addition to increased yields, increased income, improved social and economic conditions, and so on, the continuous nature of the process of impact makes it possible for negative aspects of the new varieties to be countered over time.

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### **CGIAR Personalities**

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Personalities have played an important role in the development of the CGIAR, and appropriate tribute was paid to the pioneers of the system and to their current successors at the centers during the 20th anniversary commemoration.

In that spirit the CGIAR paid tribute to a personality who left the CGIAR in 1991, welcomed an important addition to the fold and acclaimed the decision of a third to remain in a leadership position within the system.

Mr. Wilfried P. Thalwitz, fifth Chairman of the CGIAR, relinquished chairmanship on being named to head a new Vice Presidency for Europe and Central Asia at the World Bank. Mr. Thalwitz has had a distinguished career at the Bank which he joined as a Young Professional in 1963. He became Chairman of the CGIAR in May, 1990, succeeding Mr. W. David Hopper.

Mr. Thalwitz presided over several crucial meetings of the CGIAR, during a period of expansion. Under his chairmanship, the Group decided that food productivity and the management of natural resources should be twin pillars of research. This decision accelerated a trend that was set in motion under the chairmanship of Mr. Hopper in 1988.

In recognition of his services to the CGIAR, the following resolution was unanimously adopted by the CGIAR on November 1, 1991, during its annual meeting:

“Members of the CGIAR extend their felicitations to the Group’s Chairman, Wilfried P. Thalwitz, as he prepares to assume challenging new

responsibilities at the World Bank; and place on record their gratitude for the dedicated, skillful and inspiring leadership he provided them as they sought to redefine their priorities and renew their commitment to mobilizing science on behalf of the world’s poor and disadvantaged.”

Mr. Visvanathan Rajagopalan was received by acclamation as the sixth Chairman of the CGIAR. He was nominated as Chairman by World Bank President Lewis T. Preston. Mr. Rajagopalan is the Bank’s Vice President for Sector and Operations Policy.

Mr. Rajagopalan is an alumnus of Johns Hopkins University and Madras University. He held several senior government posts in India before joining the World Bank in 1965 as Engineer in the Projects Department, Water Supply Division. After holding a number of increasingly senior positions he was, in 1975, appointed Assistant Director, South Asia Projects Department, Office of Director. In 1979, he was named Director, Projects Advisory Staff (Projects Policy Department). During 1986-87, he was Director, Europe, Middle East and North Africa Region. He was appointed Vice President for Sector and Operations Policy in 1987.

Mr. Alex McCalla was unanimously invited to serve for two years beyond the end of his present term on December 31, 1992, as Chairman of the Technical Advisory Committee. From 1966 to 1979, Mr. McCalla rose through the ranks of the University of California, Davis. Following his Associate Professorship, he became Professor of Agricultural Economics and thereafter, Dean of the College of Agricultural and Environmental Sciences and Associate Director of the Agricultural Experiment Station at Davis.

In 1975, he received a Ford Foundation Travel and Study Award to review world food policy research on a global basis. Additionally, in 1979, he became Acting Dean of the Graduate School of Administration at Davis prior to returning to full-time teaching and research. In March 1984, he was appointed to TAC where he was study director of the first review of the CGIAR system of International Agricultural Research Centers.

Mr. McCalla will continue to guide TAC as the CGIAR completes its selection of priorities and strategies and reaches final decisions on such issues as the expansion of the system to include institutions dealing with forestry and fisheries.

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## *ISNAR: Ugandan Research Renewed*

Uganda has begun to reorganize and rebuild its fragmented agricultural research system under a single umbrella organization that will focus work on a smaller number of priority commodities and subject areas than in the past.

The move follows the completion in early 1991 of a major long-term planning exercise by a Ugandan working group assisted by ISNAR. The rehabilitation and reorganization will take place over five years under the auspices of the Agricultural Research and Extension Project.

Over 90 percent of Uganda's 17 million people live in rural areas. Agriculture is by far the most important sector of the economy, contributing about two-thirds of the gross domestic product. Yet the country has been investing just 0.2 percent of its agricultural gross domestic product (AgGDP) on research in this sector, far below the average for comparable developing countries.

The civil war and economic decline of the 1970s and early 1980s left Uganda's agricultural research system debilitated, as it did other spheres of national development. Research stations and equipment were damaged, destroyed or looted, there was little research activity going on and scientists were demoralized. Nonetheless, the country continued to be largely agriculturally self-sufficient and was exporting some industrial and food crops, thanks largely to a sound agricultural structure in the most productive regions.

In 1989, the government got together with major donors, and agreed on the need to draft a comprehensive strategic plan for agriculture. ISNAR, which had participated in a review of the national research system in 1987, was asked to assist with planning for research. It posted a management specialist to Uganda to collaborate with the national working group assigned to the job, and also called on in-house expertise, as well as that of several consultants.

The resulting report is a two-volume document titled "National Agricultural Research Strategy and Plan" which has been adopted by the Agricultural Policy Committee of the Ugandan government.

The centerpiece of the strategic plan is the creation of an umbrella body called the National



ISNAR / T. A. Taylor

*Tomatoes, grown by small-scale producers, are sold at a market in Mbarara, Uganda.*

Agricultural Research Organization (NARO). (This had been recommended by ISNAR staff and Ugandan counterparts in 1987.) NARO will consolidate the country's nine research institutes, several substations and 65 variety-testing sites into a smaller number of institutes, stations and programs. The government has approved the creation of NARO and is now taking necessary administrative and legal steps to set it up.

The strategic plan identifies specific commodities, production systems and other areas of research for scientists to concentrate on in the short to medium term. The ten high-priority commodities are bananas and plantains, millets, maize, cassava, sweet potato, beans, groundnut, selected vegetables, coffee and cotton. The seven high-priority production systems and research areas are cattle, Lake Victoria-Kyoga fisheries, natural forests, soil productivity, plant protection, crop management and animal nutrition and management.

Among the many other measures called for in the plan is the setting up of formal mechanisms to ensure that research responds to national development goals and to farmers' needs. These will include a National Agricultural Research Board to guide NARO and advise the government, and the participation of farmers and other clients in the planning, conduct and evaluation of research.

During 1991, ISNAR agreed to a Ugandan request for assistance with implementation of the strategic plan. The ISNAR management specialist who helped draft the plan has since been reposted to Uganda for one year.



# The Role of the CGIAR in Forestry and Agroforestry Research

The CGIAR's recent decision to incorporate forestry and agroforestry research into its mandate represents the culmination of a series of international initiatives that have been taken over the last two decades to combat the negative impacts of deforestation (see box below). These initiatives aimed to mobilize increased awareness of the potential of agroforestry and forestry research to contribute to containment of tropical deforestation, to development of technologies for resource-poor farmers, to increased agricultural productivity, to economic development and to protection of the environment.

A Bellagio Forestry Research Conference, held in November 1988, focused on identification of policy and technology interventions that could make a decisive impact on slowing down the rate of deforestation and improving agricultural productivity. For example, policy research on the impact of cattle ranching subsidies in Brazil provided the basis for significant changes

in agricultural policies that will help to slow down the rate of deforestation. Improved understanding of the complex interaction between trees, crops and livestock (which is a basic aim of agroforestry research) has contributed to development of improved agroforestry technologies, such as on-farm hedgerows of fast growing leguminous trees that contribute both to soil fertility and to livestock fodder needs. Raising the productivity of selected multipurpose fodder/fuelwood/fruit tree species (through provenance selection and in some cases through vegetative propagation) can help to improve on-farm fuelwood/fodder availability, to enhance farmers' income from cash crop tree farming and to accelerate current rates of reforestation. Recent research into mycorrhizal/tree growth interaction for regeneration of the Dipterocarp forests of South East Asia is contributing to increased productivity and sustained yield management of these valuable hardwood forests.

The Bellagio Task Force suggested five main areas

## Negative Effects of Deforestation

- Increasing soil degradation and desertification that lead to food insecurity
- Declining water quality that affects human health
- Rising costs for hydropower and irrigation projects as dam reservoirs become filled with silt from erosion
- Hardship and misery for an increasing developing country population who cannot find fuelwood or afford alternative fuels
- Declining productive employment because wood, both as a raw material and a fuel for industry, is becoming scarce and expensive
- Declining foreign exchange earnings and increasing import bills for forest products as forests are depleted of commercial woods
- Loss of biological diversity and the gene pool, which has been so important in supplying the basic genetic material underlying many of our important food products and medicines
- Cutting and burning of tropical forests, which is contributing to atmospheric emissions of "greenhouse gases," thereby amplifying the problem of global warming

—Bellagio Task Force on Forestry  
Research, 1988



FAO

*Involvement of local people in afforestation: a key to forest rehabilitation.*

as priorities for expanded investment in research:

- (1) agroforestry and watershed management;
- (2) natural forest ecology and management;
- (3) tree breeding and tree improvement;
- (4) utilization and marketing; and
- (5) policy and socioeconomic issues.

The report analyzed major weaknesses in existing research capacity and it recommended the establishment of an International Tropical Forestry Research Council, which could provide a mechanism for channeling and coordinating international, financial and technical support to forestry research. It recommended a significant increase in international funding support to forest research with a preliminary target of US\$50 million by 1995.

At this Bellagio Forestry Research Conference, the donor community adopted many of the recommendations of the Task Force report (including in particular the proposed areas of priority). However, it declined to support the notion of an independent International Forestry Research Council. Instead, it was suggested that ways and means should be explored of incorporating forestry and agroforestry into the CGIAR system.

At its mid-term meeting in Canberra in 1989, the CGIAR formally accepted in principle the incorporation of both forestry and agroforestry

research into its mandate. It requested the Technical Advisory Committee (TAC) to explore ways and means of achieving this.

### **TAC's Review of Priority Research Areas And Institutional Options**

Throughout 1989 to 1991, TAC interacted with forestry scientists and research institutions in both the developed and developing world in identifying areas of strategic forestry and agroforestry research in which the CGIAR system would have a comparative advantage. Many of these corresponded well with the findings of the Bellagio Task Force.

It also developed a series of alternative institutional options for incorporation of forestry and agroforestry research into the CGIAR system ranging from the creation of three discrete regional integrated forestry/agroforestry research centers (located respectively in Asia, Africa, Latin America) to the concept of a single integrated global center with outreach research activities in the various regions.

After considerable debate and the appointment of a special CGIAR Working Group to review these various options, it was agreed at the mid-term meeting of 1991 that the CGIAR should fund two major centers:

ICRAF—The International Council for Research in Agroforestry (which had existed since 1978, changed its name from Council to Centre in 1991) located in Nairobi, Kenya, with a specific mandate to act as the global focal point for agroforestry research (see quote below); and

*“Agroforestry is a collective name for land-use systems and practices where woody perennials are deliberately integrated with crops and/or animals on the same land management unit. The integration can be either in spatial mixture or in temporal sequence. There are normally both ecological and economic interactions between the woody and non-woody components in agroforestry.”*

—ICRAF, 1989

CIFOR—The Centre for International Forestry Research, a still to be created forestry research center, to be located in Asia with a global mandate for forestry research focused on conservation and improved productivity of forest ecosystems.

### **Major Issues Reviewed at the IFPRI Forest Policy Workshop, July 1991**

- Population distribution and growth, deforestation, and land use in wet tropical forest zones. Particular emphasis was placed on means of addressing issues related to finding ways of optimizing land use among small-scale cultivators (including shifting cultivation), the distribution and growth of populations, shortened fallow periods and opportunities for alternative land-use strategies which incorporate trees or other perennial crops.

- Options for the reclamation and utilization of degraded forest lands in dry regions, focusing on common property issues, experience with wasteland management strategies and the management of lands by public agencies.

- Intensive, sustainable land-use systems involving trees in upland watersheds and the preservation of woodlands, giving special emphasis to the characterization of these systems, upstream/downstream effects and how the quality of life of people living in or near upland watersheds could be improved by income generation through job creation.

- The role of trees in income and welfare security, addressing social and economic issues related to the use of trees and tree products in farming systems, by communities and by small-scale enterprises.

- Intersectoral policy issues affecting the forestry sector, such as policies affecting agricultural expansion and intensification, structural adjustment programs, road development initiatives and policies related to energy resource development.

It was also recognized that some of the other existing CGIAR centers could make a significant contribution to either agroforestry or forestry research needs and recommended that steps should be taken to explore those options.

For example, IFPRI has recently been reviewing its potential contribution to socioeconomic environmental policy research in the area of natural resource conservation and management. In mid-1991, it hosted a Forest Policy Workshop to help develop its own research agenda in that area (see box at left).

Other CGIAR centers have also been actively reviewing the scope for their support to forestry research. For example, IBPGR is currently preparing proposals for its involvement in conservation of biodiversity and forestry species germplasm. ISNAR is actively exploring ways and means of extending its earlier work devoted to strengthening of national agricultural research systems to play a similar role in strengthening national forestry research institutions.

The emerging ecoregional centers, particularly CIAT, IITA and ICRISAT and also ILCA, have all indicated their interest and willingness to expand research in the agroforestry area. Several of these centers had already embarked on programs for selection and improvement of leguminous tree fodder species for incorporation in tropical pasture and rangeland improvement programs. IITA, ILCA and ICRISAT have, for a number of years, been testing alley cropping systems and shelterbelt crop interactions.

### **Complexity and Location Specificity**

Among the more difficult issues that the CGIAR system has had to grapple with in reviewing options for incorporation of forestry research into the CGIAR has been the complexity of forestry research (see quote on opposite page). Both agroforestry and forestry research require a high degree of ecological site specificity to take into account local farmer and community perceptions of the both positive and negative influences of trees, on-farm productivity and human welfare and the site specificity of the very large range of tree species. These factors imply the need for a more decentralized approach to natural resource management research than has traditionally been the case for the CGIAR's commodity-oriented research programs. They also call for a multidisciplinary approach to



Conservation International / Mark J. Plotkin

*Wasteful logging methods leave behind valuable timber and damage regeneration possibilities.*

forestry research that considers socioeconomic, technological and ecological considerations.

Despite the fact that natural resource management and its components (e.g. sociology, agronomy, forestry, soils, water, plant nutrition and agro-ecological characterization) are highly location specific, TAC in its review of evolving CGIAR strategies and priorities concluded that there are, and will remain, strategic issues and environmental problems which transcend specific local production systems and geographic/ecological regions.

These include, for example, basic understanding of soil water plant relationships, energy balances, sustainable input/output models, transnational issues of forest and water resource use, watershed land-use management, migratory pests, soil erosion, forest ecosystem processes and impact of climate change on agriculture and forestry.

TAC characterized these issues in the broad research area of the "ecological foundation for sustainable production systems." It concluded that strategic research addressed to these issues could be of international relevance, that there are economies of scale in global approaches and that such strategic research can have substantial spillover benefits for both regional and national programs.

Within that framework, the decisions taken

by the CGIAR system on forestry recommended that about 30 percent of the CGIAR's allocations to forestry and agroforestry research should be devoted to global strategic research issues at headquarters and 70 percent to support research in the regions. It was emphasized that the latter would

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*"This widespread concern about tropical forests is based on a number of issues: that these forests are disappearing at an alarming rate; that the loss of so much forest has potentially disastrous effects—on soil, water, climate, the genetic richness of the globe and the supply of possible future economic products; that the uses to which the land is being converted are often not sustainable—that the forest is in fact being destroyed for no ultimate benefit, and that forest dwelling peoples are being arbitrarily displaced."*

—Duncan Poore, *No Timber Without Trees*, Earthscan Publications, London 1989, p. 1

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Women and children spend many hours a week foraging for fuelwood.

need to be conducted in the closest possible collaboration with national agroforestry and forestry research institutions.

Much of the CGIAR's forestry work has centered around designing strategic plans for both ICRAF and CIFOR that will achieve this balanced approach to research on agroforestry and natural forest conservation and management.

### ICRAF's Role and Future Research Agenda

Although it can be practiced in virtually all climatic zones by farmers living at various socioeconomic levels, agroforestry is a particularly useful tool in helping with three of the world's major concerns: rural poverty, natural resource conservation and sustainable development. Efforts to feed millions of people in marginal lands result

in widespread deforestation of the humid tropics and massive land depletion in subhumid and semi-arid areas.

A principal cause of deforestation is slash and burn agriculture, either spontaneous or after selective logging. Alternatives to slash and burn need to be found that will offer forest farmers technological options for more sustainable farming and ways to contain deforestation (see quote below). Agroforestry farming systems are among the more attractive sustainable alternatives to shifting cultivation. They are also critical in the reclamation of secondary forest fallows and in derived grasslands that often follow in the wake of short rotation shifting cultivation.

At the farm level, on-farm tree planting and improved on-farm tree management can play a major role in helping to increase on-farm productivity in contributing to increased farm income, to improved food security and to conservation of farm, soil and water resources.

Agroforestry is probably the most complicated biological challenge in the CGIAR system: how to grow annual crops with trees in a way that the inevitable competition for light, water and nutrients results in sustainable food production without degrading the environment.

There is a limited fundamental understanding of how such interactions occur at the process level and how they can best be manipulated by adapted germplasm and agronomic silviculture manage-

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*"In the subhumid and semiarid savannas of the tropics, high population densities and low woody biomass preclude shifting cultivation, but many current practices, especially overgrazing, are causing massive soil fertility depletion, leading to serious erosion and exacerbated poverty. This is particularly acute in Africa. Agroforestry technologies have the potential to revert this process and provide a sustainable supply of food, fodder and fuelwood to farmers in these regions."*

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—ICRAF in the CGIAR: The Way Ahead, 1991

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*Productivity declines under shifting cultivation in Brazil*

ment techniques. Furthermore, agroforestry systems need time to get established and to exercise key functions such as nutrient cycling and soil conservation. Much of ICRAF's work at priority locations in humid, subhumid and semiarid ecosystems is aiming to develop a predictive understanding of the major interactive processes between people, trees, crops and/or animals that will be available to or of value to each ecosystem. ICRAF has given special emphasis to socioeconomic methodology for studying local peoples' perception of agroforestry systems. It has developed a strong agroforestry network system with national research institutions in Africa, the Agroforestry Research Networks for Africa (AFRENA), and has plans to develop similar networking in Asia and Latin America.

Major gaps exist between traditional agroforestry practices and improved agroforestry technologies. ICRAF's overall strategy is aimed at overcoming these gaps through five research and four dissemination programs.

The five research programs are: (1) *Environmental Characterization and Analysis*—matching land-resource constraints to improved agroforestry systems and analyzing their effect on human equity and the environment; (2) *Multipurpose Tree*

*Improvement and Management*—including a germplasm center for multipurpose trees, fast growing species and underexploited fruit trees; (3) *Component Interaction Research*—addressing issues of competition for light, water and nutrients between trees, crops and/or livestock; (4) *Systems Improvement*—focusing on the amelioration of degraded and depleted lands and alternatives to shifting cultivation and (5) *Policy, Adoption and Impact Analysis*—focusing on the implications of policy development, defining constraints to technology adoption, assessing the impact of improved technology and providing feedback to improve technology design.

ICRAF's four dissemination programs will include: (1) training, focusing on strengthening the capacity of national institutions, (2) education, (3) information and documentation and (4) communications. All aim at enhancing agroforestry knowledge worldwide.

Research programs will be implemented using three operational modalities: activities at headquarters, collaborative networks (thematic and agroecological) and ecoregional mechanisms. In Africa, the AFRENAs will be consolidated. In Latin America and Asia, ICRAF will link into existing institutional structures dealing with agroforestry

and, at least initially, will focus on the humid tropics (four countries in Latin America and three or four countries in Asia).

Appropriate laboratory, greenhouse and field research facilities will be established in Nairobi (including a germplasm center and a training center) to enable ICRAF to fulfill its global strategic research/dissemination mandate.

In 1992, ICRAF will have 47 senior staff stationed at headquarters and at AFRENAs in 12 African countries, while 3 senior scientists are envisioned for Latin America and Asia, in order to fulfill the immediate implementation of ICRAF's global responsibilities. Major emphasis will be given to increasing the number of junior scientists and trainees from national agricultural research systems. With expansion into other geographical regions, ICRAF envisages a core of 89 senior staff by 1995.

### **CIFOR's Role and Future Research Agenda**

At the time of the mid-term 1991 meeting, the CGIAR appointed the Australian Council for International Agricultural Research (ACIAR) to undertake the task of establishing CIFOR. Since then considerable progress has been made in identifying potential board members, in drafting an establishment agreement and constitution for

CIFOR, in locating potential host countries, in defining operating procedures and in contacting regional scientists and donors to sound out their perceptions of CIFOR's future role.

The task of developing a strategic plan for CIFOR and a detailed research agenda will be the responsibility of CIFOR's Board and its Director General, whom it is anticipated will be in place in late 1992.

As a first step toward helping the Board and CIFOR management to develop a research agenda, ACIAR has interacted with many leading developing country forestry research institutions in Latin America, Asia and Africa and with developed country research leaders and the donor community.

In its interim document on the progress being made in creating CIFOR (presented to ICW 91), ACIAR suggested that CIFOR might concentrate on several of the main areas identified by the earlier Bellagio Task Force and by TAC as being of high priority in relation to improved understanding of the role of forests in contributing to human welfare, agricultural productivity and protection of the environment (see box at left).

In order to promote linkages between these program areas and to develop a thematic approach to cross country issues, a set of four common disciplinary objectives are being proposed: (1) understanding the biophysical and socioeconomic environments of present and potential forestry systems and their functional relationships; (2) creating the potential for sustainable improved productivity of forest systems for the benefit of people and developing countries; (3) providing analysis information and advice to assist in making sound policy decisions in relation to forest and land use; and (4) strengthening national forestry research capacity.

In a similar manner to ICRAF, it is proposed that CIFOR operate with a decentralized research agenda interlinking with regional nodes in Africa and Latin America. Special emphasis will be given to collaboration with the CGIAR ecoregional centers and/or other regional and national institutions. Its initial activities will focus strongly on identification of existing networks and research activities related to research topics of common interest and high priority in the various regions.

Initially, it is intended that CIFOR will maintain a small core scientific staff of some 10 to 15 scientists at its Asia region headquarters with multi-

### **Suggested Priority Areas of Research for CIFOR**

- Socioeconomic, policy and marketing research
- Improved management of natural forests
- Germplasm exploration/conservation/management
- Selection and breeding for improvement of tree species
- Ecosystem dynamics
- Utilization and management options for lesser known forest products
- Improved productivity of forest plantations
- Strengthening national research systems

disciplinary expertise covering not only forestry but also sociology, economic policy, ecology and other disciplines, with outreach scientists located in Africa and Latin America. A target budget of some US\$10 to \$15 million has been suggested for CIFOR's early years.

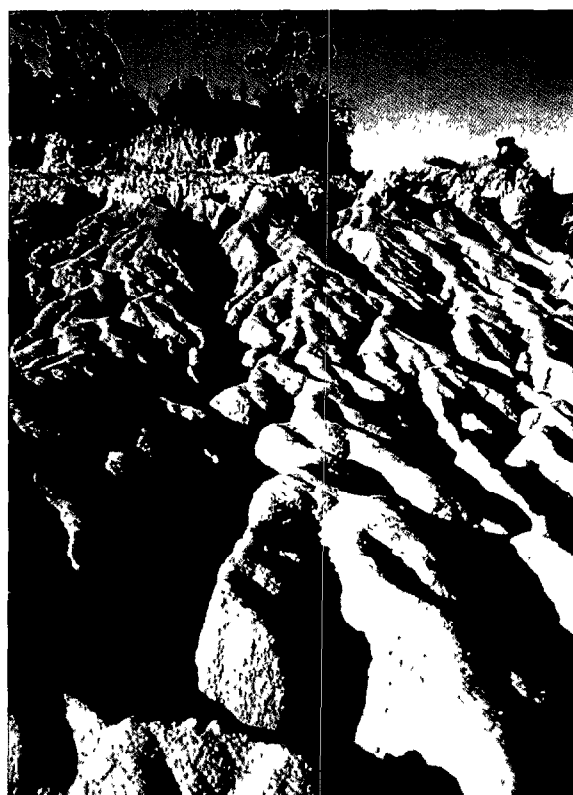
ACIAR's recent interaction with other research institutions and outreach scientists has suggested further investigation of research needs in such areas as: socioeconomic policy and marketing research relevant to containment of tropical deforestation (e.g., land tenure, agricultural taxation and settlement policies, timber concession allocation procedures, timber taxation, industrial processing export and revenue collection policies); germplasm management of both natural forest and multipurpose tree species, improved understanding of microbiological processes in forest ecosystems (particularly mycorrhizal/nitrogen fixation, tree regeneration and growth relationships); selection, breeding of both tree and forest non-wood species (such as palms, fruits, etc.); nutrient, water, soil relationships, regeneration and stand dynamics; improved productivity of tree plantations, rehabilitation of degraded lands through use of a wider range of species, management of water, nutrient cycles and development of management techniques; utilization and economic value of lesser known forest products and traditional non-market crops.

Reviewing these possible research thrusts and translating them into a Long-Term Strategic Plan for CIFOR will be one of the first tasks of CIFOR's Board and Director General.

### Collaboration Among CGIAR Centers

Given the complexity of forestry research needs and the wide range of topics to be covered argues for close cooperation among various CGIAR centers taking into account the comparative advantage of different centers to contribute to various aspects of research.

For example, in the area of policy research IFPRI is interacting with both CIFOR and ICRAF in organizing a series of regional forest policy workshops. These will focus on high priority areas of policy research that can contribute to early containment of deforestation and reduction of ecological damage, including such topics as policy options for encouraging a transition from short fallow shifting cultivation regimes to more sedentary farming



FAO

*Soil erosion exacerbated by deforestation in the highlands of Ethiopia.*

systems, incentives to encourage adoption of agroforestry and cash crop tree farming and their role in contributing to alleviation of rural poverty. Prospects for reduction of damage to natural forests will be researched through policy interventions that can provide greater incentive to local communities and private industrial companies to engage in less destructive timber harvesting practices. All three of these CGIAR centers can contribute in one way or another to such a research agenda, and close integration among them in both the policy research planning and implementation stages should help to ensure an effective impact.

### Key Issues for the Future

Combined, the various CGIAR planned forestry and agroforestry research activities outlined above (which are likely to involve at least 10 of the 18 CGIAR centers in various aspects of agroforestry and forestry research) are likely to require investment in the order of US\$30 to \$35 million by the end of 1992 with a target of US\$50 million by 1995 (which is in line with the recommendation of the Bellagio Task Force). Something in the order of 40 to 50 percent of this will be core



funding support through the CGIAR system.

This represents a significant escalation in resource allocations to forestry and agroforestry. Primary concerns of the CGIAR system will be to secure incremental funding for these activities so that the ongoing research programs of the other international agricultural research centers are not constrained and to ensure that this investment is wisely spent so that the CGIAR's research efforts make an effective contribution to the pressing forestry problems that have been the topic of much recent international concern.

The site specificity of forestry and agroforestry research and the need for a more decentralized approach to research than has been traditionally the case for the CGIAR commodity-oriented centers, raise a key issue of how to ensure high quality and effective scientific research. Much effort will be directed to identifying strategic research issues that can help to resolve across site problems at the ecoregional level and to ensuring that downstream adaptive research builds on this.

Because of the high degree of interdependence of CGIAR strategic work in forestry and agroforestry and adaptive research at the national level, much thought has been given to how to develop improved mechanisms for supporting effective networks with national forestry and agroforestry

research institutions. A recent FAO/ADB/UNDP initiative in the Asia region offers some promise for replication elsewhere. This regionally funded and managed Forest Research Support Program for Asia and the Pacific (FORSPA) is intended to provide a formal mechanism for linking up and sharing research interests of national forestry research organizations. In so doing it could become at the same time an effective network for research communication and consultation, with which the CGIAR and its centers could link up at relatively low cost compared to the effort of setting up one-to-one linkages with every national forestry research organization.

FORSPA will provide technical assistance support to national forestry research institutions in five high priority areas. The selected themes correspond reasonably well with the CGIAR's own research agenda. The strategic work and long-term research plans of CIFOR, ICRAF and other CGIAR centers could provide a useful framework for some FORSPA programs. This could facilitate mobilization and coordination of donor community funding for research programs in the Asia region.

Ways and means are currently being explored on how to strengthen similar collaborative linkages with national forestry and agroforestry institutions in other regions.



*Tree breeding and improvement research produces fast-growing, healthy seedlings*

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## CGIAR Finances—1991

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### Highlights

The CGIAR Secretariat reports annually on the financial performance of the CGIAR in the preceding year ("CGIAR 1991 Financial Report" available from the CGIAR Secretariat). That report is based on financial information made available by the centers; the 1991 report provides aggregate information on the thirteen pre-expansion centers and summary information only on the three expansion centers because financial reporting arrangements with these centers were not yet fully effective in 1991. The information provided here is based on that report.

Resources available to the CGIAR centers in support of their 1991 activities were \$302.1 million. This is \$6.2 million (or 2%) below the comparable level of \$308.3 million in 1990. As a consequence, centers' overall applications were also 2 percent less than in 1990.

The contraction in resources resulted in part from lower donor contributions and in part from lower earned income. Total 1991 grants from donors not only did not keep pace with inflation, but registered a \$2.7 million decline from 1990 levels. Increases in complementary grants of \$0.2 million were insufficient to offset a decline of \$2.9 million in core grants.

Centers responded to the reduction in total resources by curtailing their spending by \$7.1 million (or 3%) below the 1990 level. On an inflation adjusted basis, lower resources required a 6 percent retrenchment of centers' core activities.

Following an in-depth study and many interactions with donors and centers, depreciation accounting was introduced in the CGIAR in 1991. This brings CGIAR accounting practices in line with Generally Accepted Accounting Principles (GAAP) and puts a mechanism in place for centers to provision adequately for the replacement of their capital assets.

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### Funding

At ICW90, the Group approved programs and associated core funding requirements for 1991 of \$296 million. On the basis of indications provided by donors, the CGIAR Secretariat estimated at ICW90 that core funding was likely to be about \$52 million short of the approved level. The CGIAR agreed that center plans would be brought in balance with the expected funding amount of \$244 million using a mechanism adopted by the Group.

In January 1991, additional information from donors indicated that 1991 core funding was unlikely to be higher than the 1990 operating level of about \$237 million. Consequently, the CGIAR Secretariat advised centers to base their 1991 operating plans on 1990 operating levels in nominal terms. Thus, early in the year centers' 1991 core programs were planned assuming \$237 million in donor core funding.

At 1991 mid-year, core funding was estimated at \$236 million, as reported to the Group at ICW91. Uncertainty persisted throughout the year, mainly due to the fluctuation of exchange rates affecting non-dollar grants. In the end, 1991 core grant funding amounted to \$232 million, \$3 million below the actual 1990 level (Table 1).

Centers' complementary programs—activities of a specific mutual interest to one or more donors and a center—are not constrained at the system level. For 1991, centers' approved programs included complementary activities requiring funding of about \$61 million. At year end, complementary grants amounted to \$52 million, well below the planning level and virtually at the level achieved in 1990. These grants to centers' complementary programs and activities are by

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*Note All dollar amounts are in US\$. Totals in text and illustrations are computer-rounded*

**Table 1 CGIAR Core Funding by Center, 1989–1991** (in US\$ millions)

<i>CENTER</i>	<i>1989</i>	<i>1990</i>	<i>1991</i>
CIAT	28.4	27.7	27.9
CIMMYT	27.9	27.1	26.6
CIP	18.6	16.9	17.1
IBPGR	7.1	7.0	8.1
ICARDA	18.4	18.7	19.5
ICRISAT	30.1	31.5	29.4
IFPRI	8.8	9.1	8.9
IITA	22.0	22.5	22.4
ILCA	20.3	20.2	19.4
ILRAD	13.4	13.6	13.5
IRRI	26.6	29.8	29.8
ISNAR	7.5	7.0	7.6
WARDA	6.1	6.2	6.7
<b>Total Funding Received By Centers</b>	<b>235.2</b>	<b>237.4</b>	<b>236.7</b>
Net Flow To (+)/ From (–) Stabilization Fund	–10.7	–2.5	–4.7
Total Core Grants From Donors	224.5	234.9	231.9
Percent Increase	6%	5%	–1%
<b>Memo:</b>			
1. Complementary Grants From Donors	<b>47.3</b>	<b>51.4</b>	<b>51.6</b>
2. Total Grant Funding	<b>271.8</b>	<b>286.3</b>	<b>283.5</b>

their very nature project-related and thus highly restricted. Thirty CGIAR donors contributed \$46.5 million, and a number of non-CGIAR donors provided the remaining \$5.1 million.

In 1991, 39 donors contributed core grants to centers, compared to 33 donors in 1990 (Table 2). Among the six additional core donors, five resumed contributions to the CGIAR in 1991, while Korea joined the CGIAR with an initial contribution of \$500,000 allocated to six centers. The breakdown of 1991 core funding by donor group is shown in Figure 1, which also compares the average distribution by donor group during the period 1988–1990; indicating a relatively stable funding structure from a donor grouping's point of view.

Though the number of core donors increased,

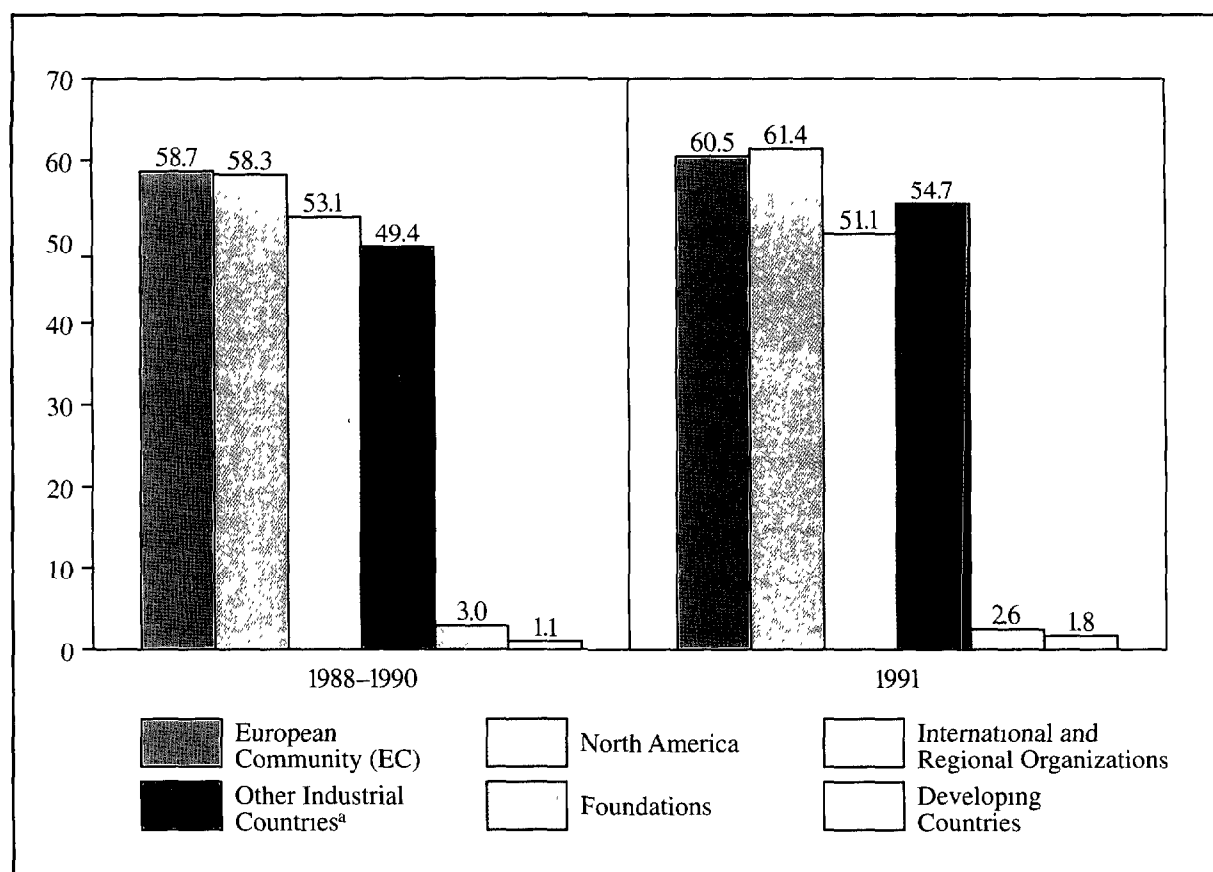
their combined grant contributions did not increase. The average contribution of the 33 donors who contributed in 1990 remained at about \$7 million; 11 donors contributed less than \$0.5 million, compared to only 5 in 1990. Consistent with the 1990 experience, 80 percent of the core grants came from 11 donors, 95 percent from 18 donors, and 21 donors provided the last 5 percent of the contributions.

The continuing delays in grant disbursements throughout the year adversely impact on the CGIAR financial management, because to meet ongoing expenditures centers are forced to carry increasingly higher levels of operating funds. At the system level these funds accumulated to \$33.2 million at 1991 year-end—representing an average of two months of operating spending or 14 percent of that year's core grants; the level of operating fund balances varies widely among individual centers. Furthermore, centers' calls on the World Bank's short-term lending facility continued to grow and to come in the latter part of the year; this forced the Bank to keep a share of its contribution undisbursed for a longer period of time and for a larger share than otherwise needed. In some cases centers had to resort to commercial credit facilities at cost to the centers and to the system as well.

In 1991, unrestricted grants—which epitomize the CGIAR—represented 69 percent of total grant funding to the centers. There is a considerable variation among centers in unrestricted versus restricted/project funding: six centers have about one-third or more of their grants restricted or complementary, while one center has less than 10 percent of its grants in these categories. These ratios reflect, on the one hand, the truly institutional support given to centers and, on the other, give insight into the margin of flexibility center management has in managing finances and activities. Figure 2 illustrates the relative importance of the core and complementary component of each of the 13 pre-expansion centers' total grant funding in 1991.

Grant funding of the three expansion centers amounted to \$20.1 million (ICRAF: \$10.7 million; IIMI: \$7.4 million; INIBAP: \$2 million). This represents an increase of 20 percent over 1990, mainly in the restricted component. It should be noted that the increase in grant funding in the expansion centers shows an opposite pattern,

**Figure 1 CGIAR Core Funding by Donor Group, 1988–1990 and 1991 (in US\$ millions)**



a OECD excluding EC and North America.

Note See Table 2 for individual donors and dollar amounts in each donor category

with restricted grants providing the bulk of the increase in their funding; consequently the share of restricted funding in their case increased from 57 percent in 1990 to 61 percent in 1991.

In 1991, the World Bank core grant to the CGIAR amounted to \$35.1 million, representing 15 percent of total core grants. Except for \$0.2 million transferred to the stabilization fund, the Bank's grant was fully allocated to the 13 centers after other donors' intentions were known. One center did not need Bank support; two centers needed Bank support at 10 percent of their core requirements; for eight centers the Bank's grant ranged from 11 to 20 percent of core requirements; and for two centers that support represented 23 to 24 percent of requirements.

It is worth noting that during the past few years the variance of the distribution of Bank grants among centers has reduced significantly. With other donors allocating their grants more consis-

tently with system relative priorities, the Bank's contribution followed increasingly the same pattern; consequently, the neutralizing effect of the donor of last resort on market signals has gradually diminished.

In 1991, the stabilization fund was reactivated but limited to risks on exchange rates of non-dollar core grant contributions. Because of that, centers drew \$4.9 million from the fund. The 1991 opening balance of the stabilization fund was \$4.6 million, to which \$0.4 million of interest income was added as well as a \$0.2 million transfer out of the World Bank's 1991 grant contribution, bringing available funds to \$5.2 million. With \$4.9 million disbursed to centers in 1991, the 1991 closing balance of the stabilization fund thus amounts to \$0.3 million. It should be noted that, because of favorable developments in host countries, ICRISAT and IITA waived their claims on the stabilization fund.

**Table 2 CGIAR Core Contributions by Donor, 1988–1991** (in millions of units)

		1988		1989		1990		1991 <sup>a</sup>	
		Natl. Currency	Equiv. in US\$	Natl. Currency	Equiv. in US\$	Natl. Currency	Equiv. in US\$	Natl. Currency	Equiv. in US\$
<i>Countries</i>									
<i>European Community (EC)</i>									
Belgium	(Bfr)	99.93	2.53	89.23	2.50	100.59	3.16	103.65	3.14
	(US \$)	—	—	—	—	—	—	—	0.17
Denmark	(Dkr)	17.80	2.53	19.20	2.64	21.65	3.57	23.65	3.39
EEC	(ECU)	6.90	7.99	8.50	9.45	9.00	12.05	9.00	11.83
	(US \$)	—	1.20	—	2.39	—	3.36	—	1.62
France	(FF)	21.00	3.30	20.89	3.60	21.00	4.10	21.10	4.10
Germany	(DM)	18.99	10.81	20.84	11.18	18.49	11.21	19.82	11.04
Ireland	(Punt)	0.10	0.16	0.19	0.28	0.20	0.31	1.12	0.34
Italy	(Lire)	5000.00	3.61	5300.00	3.79	2000.49	1.71	2600.00	2.08
	(US \$)	—	4.48	—	5.70	—	4.39	—	3.99
Luxembourg	(US \$)	—	—	—	—	—	—	—	0.25
Netherlands	(Dfl)	12.10	6.26	11.81	5.43	12.40	6.89	10.27	5.73
	(US \$)	—	—	—	—	—	—	—	0.72
Spain	(US \$)	—	0.50	—	0.50	—	0.50	—	0.50
United Kingdom	(Pound)	6.48	11.51	6.52	10.87	6.60	11.57	6.72	11.49
	(US \$)	—	—	—	—	—	—	—	0.08
<b>Subtotal</b>			<b>54.88</b>		<b>58.33</b>		<b>62.83</b>		<b>60.46</b>
<i>North America</i>									
Canada	(Can \$)	16.90	13.76	15.75	13.21	16.05	13.97	16.61	14.53
	(US \$)	—	—	—	1.16	—	1.38	—	1.20
United States	(US \$)	—	40.00	—	40.00	—	39.81	—	41.35
	(US \$)	—	2.22	—	4.14	—	5.28	—	4.28
<b>Subtotal</b>			<b>55.98</b>		<b>58.51</b>		<b>60.44</b>		<b>61.36</b>
<i>Other Industrialized Countries<sup>b</sup></i>									
Austria	(US \$)	—	1.00	—	0.98	—	1.00	—	1.00
Australia	(Aus \$)	4.27	3.13	4.33	3.70	4.80	3.81	3.58	2.79
	(US \$)	—	—	—	—	—	—	—	0.38
Finland	(Markka)	11.00	2.74	21.80	5.16	21.40	5.31	21.51	5.91
Japan	(Yen)	2591.83	20.21	2876.00	19.87	3019.63	23.19	2960.90	22.74
	(US \$)	—	—	—	—	—	—	—	0.96
Norway	(Nkr)	24.60	3.85	27.85	4.09	30.99	4.70	30.00	4.58
	(US \$)	—	—	—	—	—	—	—	0.10
Sweden	(Skr)	33.00	5.41	35.12	5.47	37.70	6.20	37.70	6.07
Switzerland	(Sfr)	7.27	5.40	8.67	5.57	8.95	5.91	8.75	6.95
	(US \$)	—	4.19	—	3.96	—	3.47	—	3.21
<b>Subtotal</b>			<b>45.93</b>		<b>48.80</b>		<b>53.60</b>		<b>54.68</b>

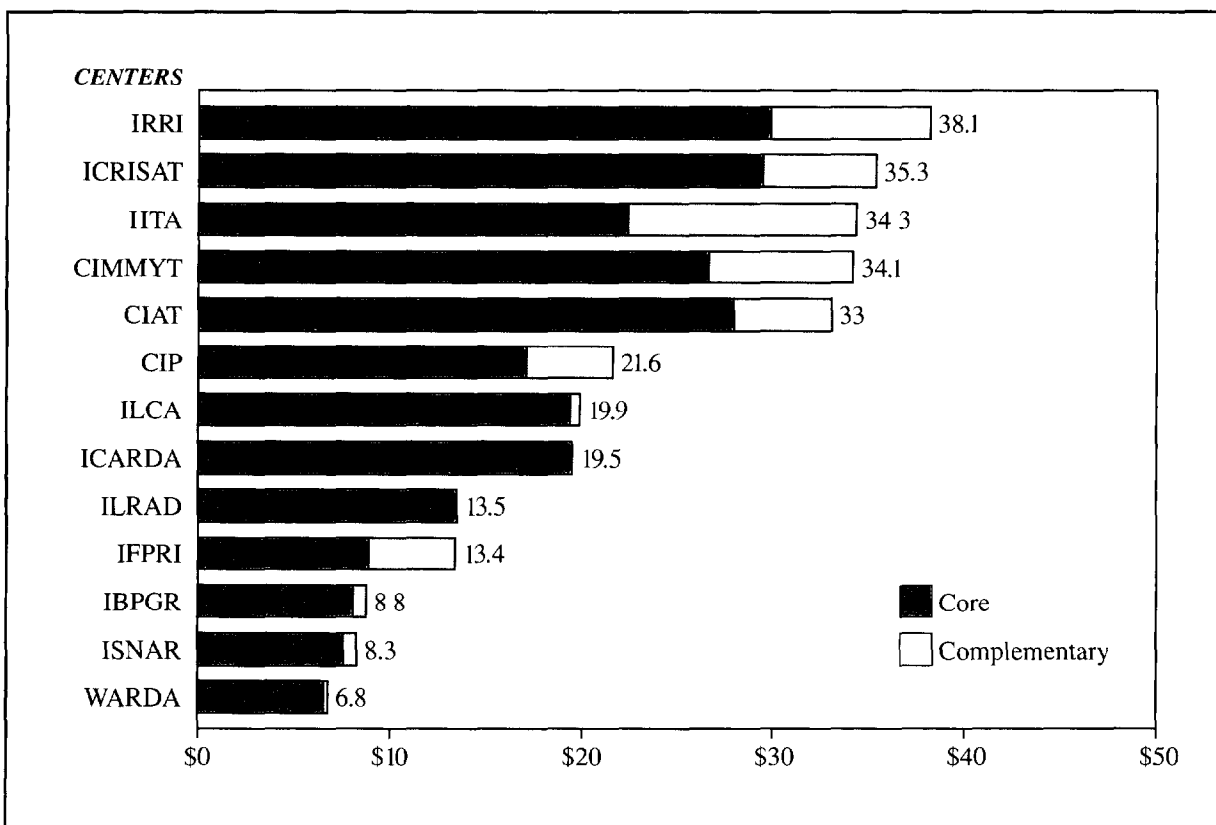
		1988		1989		1990		1991 <sup>a</sup>	
		Natl. Currency	Equiv. in US\$	Natl. Currency	Equiv. in US\$	Natl. Currency	Equiv. in US\$	Natl. Currency	Equiv. in US\$
<i>Developing Countries</i>									
Brazil	(US \$)	—	0.02	—	0.05	—	0.01	—	0.09
China	(US \$)	—	0.30	—	0.30	—	0.30	—	0.30
India	(US \$)	—	0.50	—	0.50	—	0.50	—	0.50
Korea	(US \$)	—	—	—	—	—	—	—	0.50
Mexico	(US \$)	—	—	—	—	—	—	—	0.10
Nigeria	(US \$)	—	0.12	—	0.02	—	0.09	—	0.12
Philippines	(US \$)	—	0.25	—	0.18	—	0.20	—	0.20
<b>Subtotal</b>			<b>1.19</b>		<b>1.05</b>		<b>1.09</b>		<b>1.81</b>
<i>Foundations</i>									
Ford Foundation	(US \$)	—	0.79	—	0.79	—	0.94	—	1.18
IDRC	(Can \$)	0.77	0.63	0.75	0.63	0.91	0.78	0.66	0.54
Rockefeller Foundation	(US \$)	—	0.93	—	1.89	—	1.74	—	0.90
<b>Subtotal</b>			<b>2.35</b>		<b>3.31</b>		<b>3.47</b>		<b>2.63</b>
<i>International Organizations</i>									
African Development Bank	(US \$)	—	0.72	—	1.14	—	1.23	—	1.55
Arab Fund	(US \$)	—	0.35	—	0.51	—	—	—	0.64
Asian Development Bank	(US \$)	—	—	—	0.03	—	0.63	—	0.31
IDB	(US \$)	—	10.55	—	11.13	—	10.50	—	6.31
IFAD	(US \$)	—	0.28	—	0.52	—	0.50	—	0.36
OPEC Fund	(US \$)	—	0.28	—	0.30	—	—	—	0.12
UNDP	(US \$)	—	8.99	—	7.52	—	6.33	—	6.64
UNEP	(US \$)	—	0.05	—	0.03	—	—	—	0.03
World Bank	(US \$)	—	30.00	—	33.34	—	34.33	—	35.11
<b>Subtotal</b>			<b>51.22</b>		<b>54.52</b>		<b>53.52</b>		<b>51.08</b>
<b>Total Contributions</b>			<b>211.55<sup>c</sup></b>		<b>224.52</b>		<b>234.93</b>		<b>232.02</b>
<i>Memo Items:</i>									
Contribution in US \$			101.91		109.58		118.53		121.42
(Percentage of total)			48%		49%		50%		52%
Cumulative disbursements by quarters (%)									
Quarter 1			20		19		16		17
Quarter 2			42		38		34		38
Quarter 3			77		74		56		60
Quarter 4			94		92		92		93

a. Based on centers' preliminary audits.

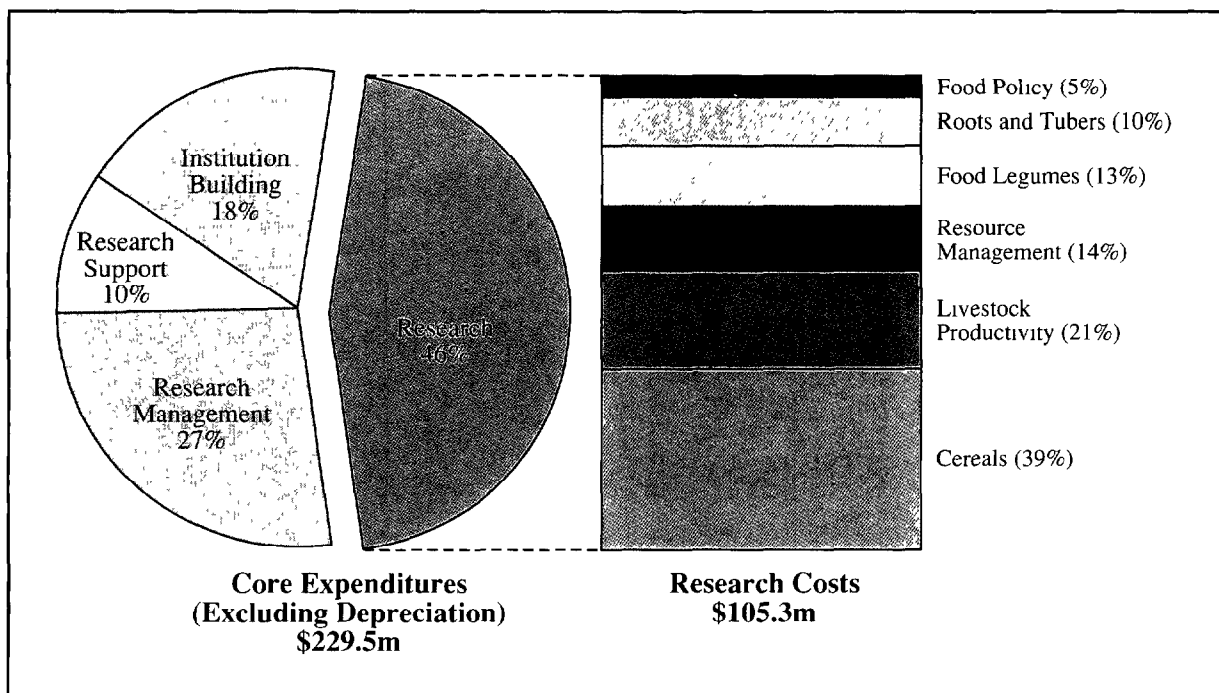
b. OECD excluding EC and North America.

c. Excludes \$0 240 million previously reported as "Other Donors' Core Contributions "

**Figure 2 CGIAR Core and Complementary Funding for the 13 Pre-Expansion Centers, 1991** (in US\$ millions)



**Figure 3 CGIAR Core Expenditures by Program and Research Sub-Program, 1991**



## Expenditures

In 1991, core expenses amounted to \$248.4 million and increments to centers' operating funds and other reserves amounted to \$5 million, for a total of \$253.5 million (Table 3). Core expenses include \$18.9 million of depreciation charges, which were first introduced in 1991. Compared with 1990, 1991 core expenses were \$1.1 million (or 0.5%) below the 1990 level. Centers' senior staff complement declined from 781 staffyears in 1990 to 755 staffyears in 1991, a 3 percent decrease. Price increases experienced by centers in 1991 over 1990 are estimated at 5.4 percent. In constant 1990 values, therefore, core expenses in 1991 declined by 6 percent.

The effect of the compression of core expenses in the past few years is reflected in the relative distribution of expenses among major program categories: the institutional cost for centers (Administration, General Operations and, to some extent, Research Support) represent a gradually increasing share of core expenses compared with Research and Institution Building. This is the reflection of the relatively lesser degree of flexibility of the former compared with the latter. In 1991, 46 percent of core expenses were for Research, down from 47 percent in 1988; Institution Building accounted for 18 percent in 1991, about the same as in 1988; Research Management, however, increased from 25 percent in 1988 to 27 percent in 1991.

Figure 3 illustrates the relative shares of core expenses of the various Research programs in 1991; Table 4 shows trends in core expenditures by programs and sub-programs in current US dollars. Over the last three years, the Legumes, Roots and Tubers, Food Policy, and Resource Management programs have increased their relative shares at the expense of the Cereals program and, to a lesser extent, of the Livestock program.

When looked at in constant US dollars, however, the trends are quite different. The absolute amount of resources for Research programs has declined in real terms by 7 percent between 1988-89 and 1991, and by 5 percent between 1990 and 1991. Consequently with the only exception of the Food Policy program—which maintained the level it reached in 1988 and exceeded somewhat those achieved in 1989 and 1990—all other Research programs are below the levels they were at either in 1988 or in the intermediate years.

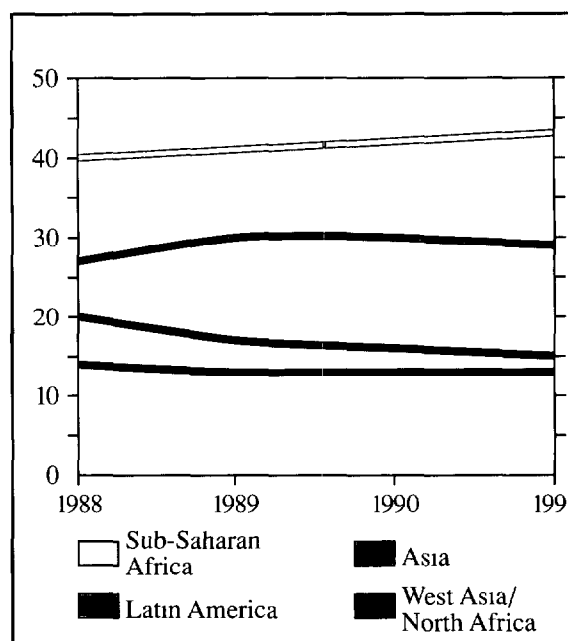
**Table 3 CGIAR Core Operating Expenditures by Center, 1989–1991**  
(in US\$ millions)

CENTER	1989	1990	1991 <sup>a</sup>
CIAT	26.61	26.29	28.99
CIMMYT	25.12	24.69	27.70
CIP	16.56	16.98	19.49
IBPGR	7.02	7.20	7.35
ICARDA	20.92	21.83	22.00
ICRISAT	28.25	29.95	30.64
IFPRI	8.75	9.18	8.99
IITA	18.85	20.57	23.40
ILCA	19.49	20.74	20.89
ILRAD	11.15	12.38	13.87
IRRI	27.48	27.79	30.39
ISNAR	7.18	8.23	8.58
WARDA	6.43	6.15	6.13
<b>Subtotal</b>	<b>223.81</b>	<b>231.99</b>	<b>248.40</b>
<b>Memo:</b>			
1. Core Capital Expenditures <sup>b</sup>	<b>18.05</b>	<b>17.55</b>	
2. Complementary Program	<b>47.77</b>	<b>54.64</b>	<b>48.69</b>

a. Includes depreciation (\$18.9 million)

b. As of 1991, centers do not expense core capital acquisitions as in previous years, but rather make depreciation charges which are included in core operating costs.

**Figure 4 Regional Distribution of CGIAR Core Operating Expenses, 1988–1991**  
(in percentages)





**Table 4 CGIAR Core Operating Expenditures by Program and Sub-Program, 1989–1991**  
(in US\$ millions)

	<i>1989</i>	<i>1990</i>	<i>1991</i>
<b>RESEARCH</b>			
<b>Crop Productivity</b>			
Cereals	42.55	41.25	40.81
Food Legumes	12.10	12.85	13.17
Roots and Tubers	10.01	10.19	10.25
	<u>64.66</u>	<u>64.29</u>	<u>64.23</u>
<b>Food Policy</b>	4.28	4.19	4.82
<b>Livestock Productivity</b>	21.38	22.72	21.67
<b>Resource Management</b>	13.85	14.71	14.60
<b>Subtotal</b>	<b>104.17</b>	<b>105.91</b>	<b>105.32</b>
<b>INSTITUTION BUILDING</b>			
Information/Communication	13.13	12.06	14.08
Organization/Management Counseling	4.21	5.61	4.87
Training/Conferences	16.57	15.83	14.28
Networks	6.55	9.34	8.29
<b>Subtotal</b>	<b>40.46</b>	<b>42.84</b>	<b>41.52</b>
<b>RESEARCH SUPPORT</b>			
<b>Subtotal</b>	<b>22.23</b>	<b>22.11</b>	<b>21.90</b>
<b>RESEARCH MANAGEMENT</b>			
Administration	32.65	35.91	35.71
General Operations	24.30	23.07	25.24
Non-Recurrent Expense	—	2.14	—
<b>Subtotal</b>	<b>56.95</b>	<b>61.12</b>	<b>60.95</b>
Depreciation <sup>a</sup>	—	—	18.71
<b>Total Operations</b>	<b>223.81</b>	<b>231.98</b>	<b>248.40</b>

a. Excludes \$0.18 million in depreciation charges which were allocated by program. Total depreciation charges including this amount are \$18.89 million.

In real terms, the Cereals program shows the sharpest decline, mainly in rice research, at 14 percent below the 1988-1989 level. The Livestock program shows a similar but a more moderate trend. The Legumes program and the Roots and Tubers program exceeded in 1991 their 1988 levels; growth, respectively, in cowpea, sweet potato and banana and plantain research explain these developments. The Resource Management program

shows a marginal decline compared with 1988.

The regional distribution of centers' 1991 core expenditures (Figure 4) indicates marginal shifts compared to the pattern of previous years. In 1991, 43 percent of core expenses were related to activities in Sub-Saharan Africa, 29 percent in Asia, 15 percent in Latin America and 13 percent in West Asia and North Africa.